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Sex Physiology of Sheep.*

By LUCIEN L. ROUX, Section of Surgery, Radiology, and Gynaecology, Onderstepoort.

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INTRODUCTION.

THE incidence of infertility among domestic animals has been the greatest stimulus towards researches upon the pathology of the genitalia of these animals (Quinlan, 1929, 1935). However, it has been realised for many years that factors also of a non-pathogenic nature are responsible for many irregularities which occur in connection with the functions of the sex organs of farm animals (Heape, 1899, 1901; Marshall, 1903; Hammond, 1914, 1921; Marshall and Hammond, 1926).

Detailed studies of sex physiology are elucidating problems which, if solved, would assist farmers in regulating the management and feeding of their stock so as to obtain maximum production during the full length of the normal life of their animals. Any degree of infertility means economic loss; moreover, the presence of inherent low fertility is transmitted to subsequent generations (Crew, 1925).

Great similarity exists between the sex organs of the main species of farm livestock (Kupfer, 1928), so that sex physiology studies of the one may very materially assist the researches on the other. Yet, in spite of the closest identity in structure of the genital organs, striking differences in function, or rhythm of function, of these organs have been found to exist, not only between closely related species, but even between breeds of the same species and this appears to be the case particularly in sheep (Heape, 1899, 1901; Marshall, 1903; Marshall and Hammond, 1926).

Pathological conditions of the genitalia of sheep are relatively seldom encountered (Marshall and Hammond, 1926), so that, in this species, the search for essential knowledge of the nature of the aetiology of infertility should concentrate largely upon genital physiology.

Such differences in sheep as the age of puberty, duration of the annual sexual season, fecundity, fertility, etc., must, to some extent, be attributed to breed characteristics. Hence, Border Leicesters, Leicesters, Dorsets, and Suffolks are among the most fertile breeds, while the Blackface is considerably less fertile due to the high incidence of barrenness (Nichols, 1924, 1926). Dorsets have two sexual seasons while other British breeds have only one annual sexual season (Roberts, 1921; Marshall, 1922). Although the fecundity of Merinos is considerably less than that of the British breeds of sheep, the sexual activity of the former breed is exceptional in that Merinos in certain parts of Australia and South Africa experience a continuous series of dioestrous cycles throughout the year, when conditions are favourable (Marshall, 1922; Quinlan and Maré, 1931).

There is, however, considerable variation in the expression of these physiological characteristics and the contention that environment plays an important rôle is not without foundation. It is of scientific interest and immense practical value to know in what way the various environic factors influence the activity of the reproductive processes, as such knowledge may bring about the introduction of methods of treatment and management which would result in greater fertility and, consequently, larger economic gains.

Climate is the principal factor in the limitation of the world's sheep population; the dense centres of sheep population are found within comparatively narrow limits of temperature, rainfall, and humidity, to which sheep are particularly sensitive during the breeding and lambing seasons (Johnson, 1924). Types of seasons have considerable influence upon the growth of sheep more especially during their first year (Hammond, 1921). Due largely to climatic preference, the heavily woolled breeds of sheep, such as the Merino, are not found to thrive in regions of high rainfall and humidity, but they prosper in the semi-arid areas in spite of wide ranges of temperatures. During poor rainfall seasons in the latter areas, Merino sheep have been said to be less fertile than during normal seasons (Quinlan and Maré, 1931).

The various types of soils and subsoils have been claimed to influence the fertility of certain British breeds of sheep. Thus, a relatively high percentage of infertility is found among Lincoln sheep run on the wolds, Shropshires on a subsoil of New Red Sandstone, and Hampshires which are not run on chalk downs (Heape, 1899). In South Africa, the insufficiency of phosphorus in the soil has been shown to be the cause of infertility in cattle (du Toit and Bisschop, 1929) and evidence exists that the reproductive powers of sheep are affected in a similar manner (Bekker, 1932).

The type, abundance, and nutritive value of natural pastures are the principal factors which determine the sheep-carrying capacity and the success of sheep farming in any area. Malnutrition, due to deficiencies in pastures, most commonly occurs in old countries on uncultivated grazings to which no return has been made to compensate for the value taken from them, or in new countries where the native stock has been improved without a corresponding grading up of the pastures. Such deficiencies generally result in emaciation; in young animals growth is stunted, while in mature animals the breeding capacity is affected (Orr, 1929). This problem of deficiencies in pastures is of particular interest in South Africa, where the natural grazing in large tracts of otherwise good sheep country becomes so leached of nutritive value during the winter months, that sheep are unable to continue the normal processes of production and reproduction unless supplementary feed is supplied.

With adequate feed and in the absence of disease, normal growth and development of the animal body take place. During the early stages of life, the sex organs develop at an equivalent rate to that of the rest of the body, and the age of puberty marks the commencement of the cyclical changes in the female, which cease only when old age overcomes general ability and the sex organs undergo gradual atrophy (Robson, 1934). While no definite data exist to

indicate the normal sexual life in sheep, what is maintained in the case of cattle no doubt can be applied to sheep, namely that considerable variations due to breed and feed exist (Hammond, 1927) The same changes which initiate the activity of the sex organs of the female at puberty, bring about the cyclical secretory and morphological effects at periods when the behaviour of the animal indicates the occurrence of oestrus. The morphological changes which take place in the uterus, fallopian tubes, and vagina, are under control of specific substances (hormones) which are produced by the ovaries. Furthermore, the activities of the ovaries are under the control of hormonic substances secreted by the anterior pituitary gland, but the factors which determine the activity of the anterior pituitary lobe have not been identified (Robson, 1934).

It must be apparent from the above remarks that: (1) In spite of similarity of the associated organs and the principles governing physiological phenomena in various breeds of sheep, certain differences are fundamentally specific and breed characteristics and such differences are reflected largely in degrees of fertility.

(2) Environic factors are responsible for a certain amount of diversity of intensity of the activity of the reproductive organs. Adverse conditions such as scarcity of feed or malnutrition result in inactivity of the reproductive organs which is reflected in infertility.

The Merino sheep population of South Africa is approximately 40 millions, the non-woolled breeds constitute about 5 millions, while the improved mutton (British) breeds exist in very small numbers. The Merino sheep industry is, therefore, of immense importance to South Africa.

It has been stated that the fertility of Merino sheep in South Africa is decidedly lower than that of sheep in Europe (Nichols, 1926); Quinlan and Maré (1931) obtained 77·7 per cent. fertility in Merinos and they state that, under less favourable conditions on South African farms, fertility is infinitely lower. It is, therefore, evident that great importance must be attached to information upon the physiology of breeding and especially to all problems affecting fertility of Merino sheep in South Africa.

The physiological changes in the ovaries of Merino sheep in South Africa, and their practical application in breeding have been studied in great detail (Quinlan and Maré, 1931). However, it is interesting to note that certain of these observations do not entirely agree with those made by Küpfer (1928), under different conditions in the same country. The varying results obtained by Küpfer were considered by Quinlan and Maré likely to be due to abnormal adverse seasonal conditions.

In certain observations made by the author, preliminary to those reported in this thesis, there appeared to be a certain similarity to the results recorded by Küpfer (1928) under western Free State conditions, rather than to that of Quinlan and Maré (1931), whose observations were made under Cape Karroo conditions. The main feature of the difference was the duration of the sexual season. According to Quinlan and Maré, Merino sheep in South Africa experience a continuous series of dioestrous cycles throughout the

year, whereas Küpfer observed the existence of a prolonged anoestrous period in non-pregnant Merino ewes, during which period ovarian activity is in abeyance. It appears important to establish whether environic factors constitute the main cause for such differences in ovarian activity, and whether deviations in the cyclical activities of the ovaries can be brought about by subjecting sheep to various treatments for extended periods of time.

REVIEW OF THE LITERATURE.

The Sexual Season.

The sexual season is the period of the year during which the non-pregnant ewe exhibits oestrus or a series of dioestrous cycles (Heape, 1900).

Sufficient information has been accumulated to establish the fact that, in most types and breeds of sheep in many countries, the sexual season is restricted to a particular time of the year, namely the autumn and early winter months (Heape, 1900; Marshall, 1903, 1922; Küpfer, 1928; Cole and Miller, 1933; Grant, 1934). From Marshall's (1922) accumulation of the earlier information, it is evident that the wild types of sheep are monoestrous, but that the domestic breeds are polyoestrous in that they experience a series of dioestrous cycles during the sexual season. The latter information has been confirmed by the more recent authors in whose observations the British and Merino breeds of sheep were included.

Instances have been reported which reveal that, in certain limited cases, sexual activity of the non-pregnant ewe is exhibited annually in two sexual seasons (Wallace, 1896; Roberts, 1921; Marshall, 1922; Marshall and Hammond, 1925). This peculiarity appears to occur particularly in Dorset Horn and Merino sheep.

Furthermore, there is evidence to indicate that Merino sheep in certain parts of Australia and South Africa and certain breeds in Central Europe are found to experience non-restricted sexual activity, or a continuous series of dioestrous cycles, throughout the year (Marshall, 1922; Küpfer, 1928; Quinlan and Maré, 1931).

It may be said, therefore, that there appears to be a gradual increase of sexual activity from the monoestrous condition of the wild species to the extreme degree of polyoestrum exhibited by certain domestic breeds of sheep.

The Anoestrous Period or Anoestrum.

The anoestrous period is the period of rest during which there is complete sexual quiescence; anoestrum occurs between the sexual seasons (Heape, 1900).

From the information cited on the sexual season, it becomes obvious that the duration of the anoestrous period decreases from that of the monoestrous wild types to that of the polyoestrous domestic breeds of sheep.

The British breeds of sheep, in their home country and abroad, experience an anoestrous period and, although some variation exists as to the length of anoestrum, the latter occurs during the spring and summer months (Heape, 1900; Marshall, 1903, 1922; Marshall and Hammond, 1926; Roberts, 1921; Cole and Miller, 1933; Grant, 1934).

Küpfer (1928) reports that the sheep of Central Europe have no annual anoestrum and, according to Marshall (1922) and Quinlan and Maré (1931), Merino sheep in certain parts of Australia and South Africa do not experience an annual anoestrum. However, Küpfer's (1928) observations on Merino and Woolled-Persian sheep in South Africa definitely indicate the existence of a prolonged anoestrous period. It is interesting to note that Küpfer found the same condition of anoestrum to exist in Boer and Angora goats during the spring and summer months under South African conditions and the observations of Warwick and co-workers (1933) on Angora goats in Texas agree with those of Küupfer on the same species; the former authors report an anoestrous period during the Texas spring and summer months.

Various reasons are advanced to explain the differences in annual sexual activity of the types and breeds of sheep. A certain amount of importance is attached to genetic differences, while at the same time it is realised that such factors as feed and climate may modify the degree of sexual activity of the non-pregnant ewe. The available information relating to these aspects of the sexual season and anoestrum is given under a subsequent section of this review.

The Dioestrous Cycle.

It has been indicated that the sexual season of the non-pregnant ewe is made up of a series of dioestrous cycles. Each dioestrous cycle consists of: prooestrum, oestrus, metoestrum, and dioestrum, (Heape, 1900).

Prooestrum.

In sheep, the external signs of prooestrum are slight, although they have been detected as being a congestion of the vulva and a discharge of mucus (Marshall, 1922; Grant, 1934).

Quinlan and Maré (1931) observed that in Merino sheep oestrus comes on gradually over a period of several hours, but Grant (1934) found that in Scottish sheep receptivity is reached within 30 to 60 minutes.

Oestrus.

"Oestrus is the special period of desire in the female; it is during oestrus, and only at that time, that the female is willing to receive the male and fruitful coition rendered possible" (Heape 1900).

The external symptoms of oestrus in the ewe have been described by Marshall (1903), McKenzie and Phillips (1930), and Grant (1934). The mutual behaviour of the ewe and ram is a reliable indication of oestrus. A non-receptive ewe runs away when approached by the

ram, while a receptive ewe goes in search of or goes to meet the ram; attention from the ram causes the ewe to vibrate her tail and she allows the ram to mount or to serve her. The external signs of prooestrum persist during oestrus.

Considerable variation in the duration of oestrus has been observed. Heape (1900) considers that in Barbary wild sheep oestrus lasts only a few hours, while in domestic sheep it lasts probably 12 hours. McKenzie and Phillips (1930) in a study of 247 periods found an average duration of 26·8 hours in Hampshire, Southdown, and Shropshire sheep; the shortest and longest periods were 5 and 50 hours respectively and seventy-four per cent. of the periods were 18 to 36 hours. Significant differences were found to exist between the duration of oestrus of the different breeds and significant differences were found between lambs and yearlings; however, such differences were not revealed between yearlings and older ewes. Grant (1934) observed that in Scottish sheep the duration of oestrus ranged between 3 and 84 hours, the mean was 22 hours and the mode 28 hours. McKenzie and Phillips and Grant observed the duration of oestrus by means of " keeled " vasectomised and vasoligated rams, frequent inspections for marked ewes having been made. Quinlan and Maré (1931) tested Merino ewes at twelve-hour intervals and they found the average duration of oestrus to be 40 hours, the mode 36 hours, and the range 24 to 96 hours.

Metoestrum.

Metoestrum, the waning of oestrus, is gradual; it lasts for a period of several hours (Quinlan and Maré, 1931; Grant, 1934).

Dioestrum.

Dioestrum is the period of the dioestrous cycle during which no sexual desire is shown; it is an interval of quiescence (Heape, 1900; Marshall, 1922). Heape considers that the two quiescent periods, dioestrum and anoestrum, are homologous, that the one is a modification of the other, and that " the modification is no doubt related to an increased or decreased power of reproduction ".

Quinlan and Maré (1931) found the length of dioestrum in Merinos to range from 12·5 to 17 days and the mode is given as 15 days.

Periodicity of Oestrus.

Usually, oestrus recurs with marked regularity during the sexual season. The periodicity of oestrus, or the length of the dioestrous cycle, depends largely upon the duration of oestrus and dioestrum.

Quinlan and Maré (1931), and Quinlan, Maré, and Roux (1930), (1932) found the mode of the dioestrous cycle in Merinos to be 17 days and, while the great majority of cycles were 16 to 18 days, cycles as short as 6 days and as long as 68 were observed. McKenzie and Phillips (1930) report an average dioestrous cycle of 16·6 days for certain British breeds of sheep; 79 per cent. had cycles from 14 to 16 days; there were no significant differences due to age and breed. Grant (1934) found the mean duration of the dioestrous cycle

in Scottish sheep to be 16·4 days, the mean deviation being ±0·8 days. He points out that Küpfer (1928), Sanctis (1926), and Schmaltz (1921), found a somewhat longer cycle to exist in Central European sheep and, by compiling all available data, Grant gives the average duration of the cycle as 16·8 days and the mode as 17 days.

Variations in the length of successive dioestrous cycles are small. Quinlan, Maré, and Roux (1932) found that in 45 per cent. of cases no variation occurred while variations of one day occurred in 45 per cent. of cases.

Considerable evidence is available to indicate that the interval between two exhibitions of oestrus is frequently the length of two or even more dioestrous cycles. Grant (1934) suspects that in cases in which observations are made only once daily, short oestrous periods might be missed, but he points out that, even when " keeled " rams were run with the ewes constantly, abnormally long interoestrous periods were observed by McKenzie and Phillips (1930) and Casida and McKenzie (1932).

The Changes in the Reproductive Organs.

The preceding details deal with the external manifestations of sexual activity in the non-pregnant ewe. It is now necessary to consider briefly the rhythmic alterations occurring in the reproductive organs and to indicate the relationship between the various sex organs.

It is not necessary to enter into great detail upon the anatomical structure and the physiological changes experienced by the genital organs. Such details can be found in the well-known text-books and monographs on reproduction in mammals. However, for the present purpose, the periodic changes experienced by the ovaries appear to warrant special attention.

The morphological and physiological changes occurring in the reproductive organs of the non-pregnant ewe have been studied by Marshall (1903), Küpfer (1928), Quinlan and Maré (1931), Casida and McKenzie (1933), and Grant (1934).

The researches of certain of the above investigators (Marshall, Küpfer, Casida and McKenzie, and Grant) indicate that during anoestrum all the sex organs are in a quiescent and anaemic state; the ovaries are small and compact, but many small follicles may be present. Grant states that it is not known whether the follicles are constantly growing and regressing during anoestrum or whether follicular development is entirely arrested. About six weeks prior to the commencement of the sexual season, mitosis begins in the reproductive organs and eventually the latter assume the condition evidenced during the oestrous period. Grant's findings reveal that one or more cycles of ovulation and development of corpora lutea may occur before the regular sexual season, while occasionally an ovarian cycle takes place without the exhibition of heat at the end of the sexual season. Küpfer (1928) also observed the occurrence of ovulation without oestrus and he is of the opinion that such ovulations would not lead to pregnancy.

During the dioestrous cycles of the sexual season, many alterations take place in the ovaries, uterus, and other secondary sex organs (vagina, cervix, fallopian tubes). During the interoestrous period, or dioestrum, the organs prepare for the reproductive climax, oestrus, when the uterus is enlarged and distended and ovulation takes place.

The morphological changes in the ovaries during a dioestrous cycle embrace: follicular maturation, ovulation, and the formation and subsequent atrophy of luteal tissue. The secretory changes in the ovaries result in the liberation of a specific hormonic substance, oestrin, which, together with the corpus luteum hormone, controls the cyclical alterations in the various divisions of the uterus.

Through ovarian control, the endometrium or internal and secretory grandular portion of the uterus undergoes changes necessary for the nidation of the ovum. During the latter part of oestrus, the fallopian tubes and uterus are in a fit state for the reception of the ovum.

More recently, it has been discovered that both the morphological and secretory changes in the ovaries are subject to a specific hormonic control by the anterior lobe of the pituitary (Zondek and Aschheim, 1927; Smith and Engle, 1927—*cit.* Robson, 1934). Hence, the influence of the substances capable of being excreted by the pituitary upon the ovaries may bring about: (*a*) follicular maturation, ovulation, and oestrin secretion, and (*b*) the formation of luteal tissue, followed by the secretion of luteal hormone which results in the inhibition of oestrus.

The Specific Changes in the Ovary.

As the changes in the ovaries are of particular interest in the present sudy, it appears necessary to review the literature upon the ovarian activity of the ewe in considerable detail.

From a practical point of view, early conception, regularity of lambing, and the number of lambs born out of a single ewe or a flock of ewes, are indications of ovarian activity. Hammond (1921) points out that the number of ova shed is the main factor influencing fertility, but the same author draws attention to the fact that foetal atrophy and unobserved early abortions do occur in sheep. Clark (1934) found that ovulation rates are approximately the same as the lambing averages. However, the probability of the presence of rams of varying fertility must not be lost sight of in cases in which the fertility of the ewe is used as a measure of ovarian activity (Quinlan and Maré, 1931; McKenzie and Phillips, 1933). Nichols (1924, 1926) draws attention to various environic factors which may affect fertility. Therefore, a true reflection of ovarian activity is not obtained by considering lambing percentages and this may be the case especially when marked low fertility is observed. However, the possibility of the above irregularities existing does not condemn a restricted use of data on lambing percentages, more especially when the animals considered have been maintained under similar conditions and management, and the number of animals considered is large. Lambing results are, therefore, referred to in this and subsequent sections of this review. On the other hand, it must be emphasized

that greater importance is attached to oestrous observations and even more to the examination of the ovaries as being reliable methods of determining and studying ovarian activity.

Puberty marks the onset of ovarian changes. Marshall (1922) remarks that puberty is not accomplished at once. It is the period during which the animal becomes sexually mature when the essential organs of reproduction undergo a great increase in size.

Evidence exists which indicates that, even at a very young stage, the ovaries are not entirely static: Hammond (1927) cites the reports of Heitz (1906) and Käppeli (1908) stating that out of 75 ovaries of calves between 5 and 12 weeks old, 80 per cent. contained a follicle over 0·3 c.m. in diameter, and that in four cases a folicle of 1·3 c.m. was found. Robson (1934) contends that it is generally accepted that in mammals a large number of ova are present in the ovaries at birth, but that they remain quiescent until maturity.

Marshall and Hammond (1925) consider that during growth the internal secretions are concerned with growth and that the secretions are insufficient for the development of sex cells. Parkes (1929) points out that the idea of somatic control of the ovaries has been vindicated by recent work on the effects of the anterior pituitary substance on the ovaries. The same author says that the development of the ovaries before puberty tends to be sporadic; it may include one or more waves of growth which are followed by retrogressive changes.

Although little exact information with regard to the age of puberty of sheep is available, evidence indicates that ewes of 9 to 12 months are sexually mature; yet considerable variation between breeds and individuals within breeds appears to exist. McKenzie and Phillips (1930) found that the age of puberty in Hampshire, Shropshire, and Southdown sheep varies considerably, the first named breed being well in advance of the others. Well grown Hampshire lambs averaging 86 pounds exhibited their first oestrus when from 187 to 250 days old. According to Quinlan, Maré, and Roux (1930), 50 Merino ewes under oestrous observation showed oestrus at 9 to 10 months old; but, according to an analysis of other data presented by the same authors, 11·4 per cent. of the 50 Merino ewes when 18 months old, did not show oestrus during four consecutive months of observation and under conditions where Merinos are maintained to be sexually active throughout the year. Griswold (1932) found that Hampshire-Rambouillet ewes bred as lambs gave an 86 per cent. lamb crop. Golf (1934) reported 129 per cent. lambs in German Mutton Merino sheep bred at 10 to 12 months of age. Nichols (1926) points out that barrenness in shearing (young) ewes is due frequently to failure to take the ram which may be due to sexual immaturity, hence reduced or delayed ovulation.

Robson (1934) in reviewing the work of Smith and Dortzbach (1929) and Wolfe and Cleveland (1931) on the secretions of the anterior pituitary of immature animals, states that " . . . . the anterior pituitary lobe contains active gonadtrophic hormones before the onset of maturity and the ovary is capable of reacting to these hormones and yet under normal physiological conditions the ovary

does not mature at that time. Up to the present no satisfactory explanation for this apparent paradox has been found ". Robson considers that, as the injection of additional hormone into immature animals brings about sexual activity, it is likely that the rate of secretion of the untreated immature animals is not at a sufficiently high level to stimulate the ovary.

Descriptions of the ovary of mature ewes have been given by many writers and more recently by Küpfer (1928), Quinlan and Maré (1931), and Grant (1934).

The number of follicles which rupture during any one oestrus varies. Grant found that out of a total of 441 ewes, the average number of corpora lutea present was 1·87; there were 54 ewes with 3 corpora, 8 with 4, and 3 with 5 corpora. The average number of corpora found present by Marshall (1903) was 1·25 and by Hammond (1921) 1·45. It appears from the work of Quinlan and Maré (1931)on Merino sheep, that the liberation of more than one ovum seldom occurs. Grant (1934) states that there is a tendency for the number of ova shed to decrease towards the end of the sexual season. On the other hand, Clark (1934) states that cases of double ovulation occur fairly uniformly throughout the sexual season.

Usually, follicles of various sizes are found in the ovaries, but all these follicles do not mature as, after ovulation, the remaining follicles degenerate (Sandes, 1903—*cit.* Hammond, 1914). Marshall (1922) considers follicular atrophy a natural process; only when it becomes excessive does it result in sterility, in which case the failure of some follicles to mature is probably due to insufficiency of stimulating power at the disposal of the ewe.

According to Quinlan and Maré (1931), shortly after ovulation there is rapid enlargement of the follicle destined to rupture at the next oestrus, but Grant (1934) found little early development, growth taking place uniformly throughout the interoestrous period. In the sow, McKenzie (1926) found the growth of follicles to be slow during the early part of the interoestrous period, but very rapid about three days before the onset of oestrus.

The final stages of the mature follicle in the ovary of the ewe have been described by Küpfer (1928), Quinlan and Maré (1931), and Grant (1934). At the commencement of oestrus, well developed follicles reach a diameter of about 1 c.m., the capsule is thin and transparent, the contents appear slightly purple in colour, and one or two capillaries are seen transversing the follicular capsule. Rupture of the follicle is preceded by the elevation of a small papilla above the general surface and ultimately the immediate cause of the rupture is considered to be the pressure of the follicular fluid. While one ovulation from each ovary may occur, a double ovulation from one ovary has been evidenced; also, the same ovary may ovulate three times in succession.

Grant (1934) indicates the variations reported with regard to the time of ovulation relative to the onset of oestrus. It appears that in most cases ovulation occurs 24 hours subsequent to the onset of oestrus. In Merinos, Quinlan and Maré (1931) state that ovulation

rarely takes place before the 36th to the 40th hour of oestrus. Grant considers that it occurs earlier in Scottish sheep than in other breeds. Green and Winters (1935) state that ovulation in sheep occurs as the animal passes from heat.

Normally, ovulation does not occur during pregnancy, during which period the follicles remain small and unaltered (Quinlan and Maré, 1931). However, authentic cases of superfoetation have been reported by Smith (1927, *cit.* Grant, 1934) and Grant (1934).

Ovulation has been observed 10 to 15 days post-partum, but such ovulations are not accompanied as a rule by oestrus when the ewe suckles its lamb (Quinlan and Maré, 1931). Parkes (1929) indicates that it has been shown by practising ovarectomy that the inhibition of oestrus during lactation is set up through the ovary, and that the absence of oestrus is not due to the heavy drain upon metabolism resulting from lactation.

Oestrus has been observed to occur soon after abortion. Nichols (1924) reported a case in which a ewe aborted during early pregnancy and was served the following day. Quinlan and Maré (1931) observed normal oestrus in a Merino ewe 17 days after the birth of a still-born lamb and, in a similar type of case, van Rensburg (1935) observed normal oestrus after 21 days.

Shortly after ovulation, luteal cells are formed by " the hypertrophy of the follicular epithelial cells and the ingrowth of connective tissue along with blood vessels " (Robson, 1934). The evolutionary and involutionary changes of the corpus luteum in the ovary of the ewe have beeen described by Küpfer (1928), Quinlan and Maré (1931), Casida and McKenzie (1933), and Grant (1934). The corpus luteum becomes conspicuous 48 hours after ovulation; within five days it occupies a large portion of the ovary, when it may be 0·5-0·7 c.m. in diameter; it reaches its maximum size at about the middle of the interovulation period of its formation, when it is about 0·9 c.m. large and has a central cavity containing a fluid. As its cycle advances, it changes from a blood red to an opaque pink colour. Although Quinlan and Maré state that the corpus luteum remains little changed in size until after the commencement of the next oestrus, the other investigators report that the corpus starts degenerating during the latter part of the interovulation period. Atrophy becomes rapid after the formation of the newly formed corpus luteum and the colour changes to a yellow, then to a dark brownish yellow. The last trace of the corpus is a brownish pin-point speck on the surface of the ovary. Grant's (1934) statement to the effect that Quinlan and Maré (1931) misinterpreted the changes in the corpus luteum prior to ovulation, does not appear to be substantiated. The ovaries shown in the coloured drawing submitted by the latter authors, are of natural size and they were made from the fresh ovaries taken from sheep immediately after slaughter. Moreover, it is very evident that the greatest care was taken in representing the appearance of the corpus luteum from day to day during the interoestrous period.

The corpus luteum of oestrus is a ductless gland and its chief function is the inhibition of oestrus, which effect it produces by a specific hormone.

The corpus luteum of pregnancy, or corpus luteum vera, is highly vascular and it remains present in the ovary during the entire period of pregnancy (Quinlan and Maré, 1931). However, by the end of the third month slight changes commence, but more marked alterations in size and colour are noticed just previous to parturition, after which rapid changes in size take place.

During lactation, atrophy of the corpus luteum vera continues, and three months after parturition, it is reduced to a vestige (Grant, 1934). Only in rare cases does ovulation occur shortly after parturition (Quinlan and Maré, 1931). In spite of the absence of a corpus luteum, oestrus does not generally occur during lactation; Hammond (1925, *cit.* Robson, 1934) has suggested that lactation interferes with the nutrition of the ovaries thus inhibiting the occurrence of normal dioestrous cycles.

As previously indicated, the corpus luteum is a gland of internal secretion and the hormone which it secretes assists the ovarian hormone, oestrin, in regulating the cyclical alterations in the various divisions of the uterus. Although it is generally understood that secretions of the corpus luteum inhibit oestrus, Robson (1934) states: " None of the evidence so far adduced, however, proves conclusively that the inhibitary effect upon oestrus is definitely due to known luteal hormones and the possibility that unknown or even an unspecific factor may be responsible for some of the results observed has by no means been excluded. Moreover, it is known that other substances besides the luteal extracts have an inhibitary action on the occurrence of oestrus, e.g. adrenaline " (Robson, 1932). Robson in his review also indicates that it appears to be definitely established that the luteal hormone is important in the early stages of gestation in all species, but that the contentions with regard to the function of the corpus luteum during subsequent stages of gestation are contradictory. It is not definitely known whether there is any interrelation between the corpus luteum and the mammary gland.

Aschheim and Zondek (1927) and Smith (1927, *cit.* Robson, 1934) discovered that large quantities of oestrin are excreted in pregnancy urine. Zondek (1930—*cit.* Robson, 1934) has standardised two gonadotropic substances, Prolan A. and B., recoverable from pregnancy urine or from the pituitary, in terms of mouse or rat units. While a considerable measure of success has been achieved by artificially inducing ovulation and oestrus in small animals through the administration of preparations containing gonad stimulating hormones, only in limited instances have similar successes been achieved with domestic animals such as the ewe. Cole and Miller (1933) found that oestrus and ovulation can be induced in sheep during mid-anoestrum by administering sufficient amounts of gonad stimulating hormones in serum from pregnant mares. The importance of giving a second injection of the serum 16 days after the first is stressed. Warwick and co-workers (1933) used a serum prepared from human pregnancy urine on goats and, while ovulation was found to have occurred in several cases, oestrus was not produced. As details were not given in the report available, it is not known whether the precaution of giving the second injection after a particular time was observed.

The Genetic Aspects of Ovarian Activity.

During the consideration of the sexual season in the various breeds and types of sheep, it was deduced that there appeared to be a gradual increase of sexual activity from the monoestrous condition of the wild species to the extreme degree of polyoestrum exhibited by certain domestic breeds of sheep.

Marshall's (1922) accumulated information on the wild types of sheep, O. tragelophus, O. burrhel, O. musiman, O. vignei, O. ammon, O. canadensis, O. poli, and O. argili, indicates that they are all monoestrous. Parkes (1929) states that the wild prototypes of the cow, pig, sheep, and goat, all probably exhibit a restricted sexual season, which in the case of the last two appears to be in the autumn, but that domestication extended the season so that domestic strains breed at almost any time. He further states that, in the domestic strains, the greatest readiness to breed it still found at the time which corresponds to the primitive sexual season.

Through domestication, improved methods of husbandry no doubt have encouraged the establishment of longer sexual seasons, which increased the probability of fertilisation and consequently the fertility of the flocks. Marshall (1903, 1922) and Marshall and Hammond (1925) indicate that variations in the time of the occurrence and the duration of the sexual season are definitely breed or racial characteristics. While most breeds in Great Britain experience many dioestrous cycles during their annual sexual season, the Scottish Blackfaced sheep in the Highlands have only two dioestrous cycles annually. While the sexual season of most British breeds of sheep is from October to February, the Limestone sheep of Westmorland and Derbyshire and Dorset Horn sheep are capable of breeding more than once annually. Roberts (1921) found that, in the United States, Shropshires are most active during October to December, while in Dorsets two annual sexual seasons occur during the months May to July and September to December. As previously indicated, Merino sheep in certain parts of Australia and South Africa experience greater annual sexual activity than any other breed, as in the former a continuous series of dioestrous cycles is experienced throughout the year (Marshall, 1922; Quinlan and Maré, 1931).

In comparing the early breeding characteristics of various breeds, Darlow (no date) and Russell (1919) found significant differences. The Merino was the best early lamb producer; 80 per cent. of the ewes brought lambs before January as compared with 40 per cent. of the Dorsets. Although the Shropshire was found to be a late breeder, the Shropshire-Merino crosses were earlier breeders than the Merino. Darlow states that, while the early breeding character is not common to all Dorsets, it appears to be particularly dominant over late breeding when the Dorsets are selected for the former character.

As previously indicated, fertility can, to some extent, be used as an indication of ovarian activity. Heape (1889) found remarkable differences in the fertility of various breeds and he contended that the results of his investigation clearly indicated that fertility is a

racial characteristic. Heape remarked upon the remarkably high fertility of Suffolks, Shropshire, and Dorsets and the serious state of low fertility among Southdowns of those times. The later investigations of Nichols (1924, 1926) led to the definite conclusion that differences in fertility between different breeds and within breeds are fundamentally genetic. Marshall and Potts (1924) state that various breeds and strains have each an inherited limit of fertility. In comparing the fertility of several breeds of sheep in the United States, they found that Dorsets gave the best returns and Rambouillets lowest returns per 100 ewes; whereas 146 and 163 per cent. were obtained from two year old and aged Dorset ewes respectively, the equivalent returns from Rambouillets were 111 and 125 per cent.

It is logical that the factors which yield high fertility are those which produce a high proportion of multi-births. Hammond (1921) has indicated that the limiting factor in fecundity is the number of ova shed at oestrus. Age appears to play an important role so far as fecundity and, consequently, ovarian activity are concerned; although variation between different breeds exists, greatest fecundity occurs during the sixth year of the ewe's life. Marshall and Potts (1924) have shown that analyses of flock records indicate an increase in proportion of twins born until ewes are 5 to 6 years old; ewes 2 years old produced 111·4 per cent. lambs, while 6 year old ewes yielded 161·2 per cent. lambs. In American Shropshire sheep, the percentage of multi-births increases up to 4 years and then remains fairly constant through the eighth year; ewes 16 years old were productive (Roberts, 1921). Langlet (1934) reports that in German Mutton Merinos optimum lambing results are obtained in the sixth year, but in German white-headed mutton sheep best lambings are obtained from ewes 3 to 4 years old. As old ewes are either sold or slaughtered before they reach senility the full extent of their reproductive ability is usually unknown. However, Pearl (1913) has reported a case of abnormal fecundity in a " native " ewe which gave a farmer 19 fleeces and 36 lambs. The breeding details were as follows: first 2 years, 2 singles; third year, twins; next 6 years, triplets; next 6 years, twins; next 2 years, singles; last 2 years, no lambs.

Pearl (1912, *cit.* Hammond, 1914), has shown that a fertile strain of fowl does not necessarily contain more oocytes in its ovaries than an infertile strain and that the development and growth of the oocytes are caused by a physiological factor. Crew (1925) contends that it is possible to bring a family of animals to an end by deliberately neglecting the fact that its individuals are of low fertility. Marshall and Hammond (1925) draw attention to the importance of using rams from highly fertile strains in order to maintain or increase the fertility of flocks through their genetic constitution. Crew (1925) draws attention to the fact that, while it is possible to increase the number and intensity of the dioestrous cycles in polyoestrous animals, there is no evidence that special treatment can convert the constitutionally monoestrous into the polyoestrous, and that, although environic factors may affect the oestrous cycle, it is certain " that differences in the nature of this cycle fundamentally are specific and breed characters ".

The Effect of Environic Factors upon Ovarian Activity.

Climatic.

Considerable evidence has been advanced to indicate that environic factors such as climate, soil, and nutrition, influence the extent of sexual activity in sheep.

Marshall (1922) is of the opinion that the occurrence of the sexual season in any one country or locality is closely connected with the climatic conditions and the periodicity of the seasons; sheep in Great Britain and South Africa adhere to this rule as in both countries they breed in the autumn. Marshall contends that the breeding season is controlled through natural selection by the needs of the next generation.

Variation in the duration of the sexual season is found to result due to changes of environmental conditions. Thus, Scotch Black-faced sheep in the Highlands experience only two dioestrous cycles during the annual sexual season, but in the Lowlands as many as five or six dioestrous cycles have been observed (Marshall, 1922). Wallace (1896) states that, in South Africa at high altitudes where sheep depend only on the veld, lambing begins in September or October. He indicates a lull in lambing due to ewes not coming in season, but he states that in the low country, below the second range of mountains, autumn lambs are obtained, which indicates that a sexual season must have occurred in the spring.

Küpfer (1928) found that under South African western Free State conditions, Merinos and Woolled Persian sheep and Boer and Angora goats are sexually active only during the autumn and early winter months. Küpfer, realising that greater sexual activity is shown by Merinos in Australia (Marshall, 1922) and sheep in Central Europe (Küpfer, 1928), considers that sheep in South Africa have adapted their ovarian functions to climatic conditions. He doubts " . . . whether sheep in various parts in any country or in different countries conform to the same type of organogenesis and follow the same periodicity in organic functions ". This author considers that the short period of sexual activity observed by him under South African conditions might be an adaptation to the conditions necessary for the rearing of the offspring. It is interesting to note that this generalization is supported by the same author's observations on equines in South Africa (Küpfer, 1928). Küpfer found that, in horses and donkeys, sexual activity was limited to the months October to March, so that, after a gestation period of about eleven months, parturition takes place at the beginning of and during the spring ,when conditions are favourable for lactation.

On the other hand, under the semi-arid conditions of the South African Karroo, Quinlan and Maré (1931) observed continuous annual sexual activity in Merino sheep. They state that, under Karroo conditions, the absence of rain for extended periods adversely affects the pasture and results in irregularity of the dioestrous cycles.

Some interesting observations upon sheep imported into the United States were recorded by Russel (1919). It was found that imported Dorset Horns were not as fertile as acclimated Dorset Horns, as, in the case of the former, 10 per cent. proved barren, 20 per cent. failed to breed before the autumn during the first two seasons, and

50 per cent. of those that lambed dropped twins. In the case of Shropshires, out of 17 ewes, 6 proved barren. Although no data are reported, Quinlan and Maré (1931) state that they consider that it takes six months for the acclimatisation in South Africa of British breeds of sheep. Also, the same authors are of the opinion that temporary sexual inactivity may result when sheep are transferred from humid coastal regions to dry Karroo conditions.

Endeavours have been made to recognise the independent effects of climate and nutrition upon sexual activity in sheep, but little information is based upon actual experimentation.

Johnson (1924), in considering the densely sheep-populated regions of the world with respect to temperature, rainfall, and humidity, states, that in the most important sheep countries of the world, the winters are mild, the summers are cool, and the humidity is considerably lower in summer than in winter. Under such conditions, the mean temperature ranges between 28° and 77° F., the rainfall between 0·3 and 4·5 inches per month, and the relative humidity between 55 and 70 per cent. at the higher temperatures and 65 to 91 per cent. at the lower temperatures. Johnson further states that the " rutting season " falls within narrow limits of temperature, rainfall, and humidiy. He appears to agree with Hammond's (1921) contention that the " rutting season " comes with a falling temperature, and it is said that, when the late summers and autumns are hot, the ewes will not breed until late. The results of Asdell's (1926) analysis of the Kid Register of the British Goat Society clearly supports his contention with regard to the relationship between temperature and sexual activity in caprines. Asdell states that it is just as the reproductive period is setting in, or as the ovary awakens from the quiescence of anoestrum, that the influence of temperature is most felt. Slight activity starts in June, the rise is gradual during July and August, after which it becomes steep, and a maximum is attained in October; there is a slight decline to November, after which the decline is steeper, and it becomes more gradual until a minimum is reached in May. This author considers the August temperature most important and, while hot summers were found to delay matings, very cold temperatures during December resulted in a smaller number of mating during that particular year. McKenzie and Phillips (1932) found that, when ewes were subjected to low temperatures (44°-48°) in an ice chamber during the day or the night for 10 days, there were no significant differences between the experimental and the control ewes in so far as the number of days required for the ewes to show oestrus was concerned. Elpatjevskii (1934) states that low temperatures below 15° C. reduced the number of sheep coming on " heat " by 25·8 per cent.; the effect of cold weather was enhanced by windy weather. Also, dull cloudy weather had a harmful influence and snow-fall reduced the number of ewes showing " heat " by 17·5 to 30·0 per cent. Asdell (1926) considers the thermo-regularity mechanism of importance, but not absolute in action, and that summer heat probably increases the temperature of most animals, especially of those in which the sweat glands are poorly developed, as for example, the sheep and goat. Asdell suggests that summer temperatures may be above that at which follicular development may be possible, winter

temperatures may be below, while spring and autumn temperatures may be most suitable. He further suggests that animals with a polyoestrous breeding season which lasts practically the whole year, appear to be those in which the temperature regulatory system is most efficient.

Nutritional.

The effects of nutrition upon sexual activity of ewes have been subject to much discussion and this is especially true of the practice of " flushing ".

The advantages of " flushing " ewes some time before the commencement of the breeding season are explained and supported by Marshall (1903, 1922), and Marshall and Hammond (1925). It is advocated that ewes entering the sexual season should be in a growing or gaining condition. At the beginning of the sexual season, feed is still comparatively plentiful and the authors found that the greater percentage of twins are born during the first part of the lambing season which would indicate that the generative activity of ewes tends to be greatest at the commencement of the sexual season.

Marshall and Potts (1924) made observations on the effects of " flushing " on a total of over 350 ewes, and they found that the " flushed " ewes gave 18·7 lambs more per 100 ewes than did the " unflushed " groups. However, it is indicated that " flushing " with grain showed no advantage over good pasture grazing, nor could it be said that " flushing " brought ewes to service earlier, and it is surprising to note that more cases of returning for a second and third service were found among the " flushed " groups.

Satisfactory results from " flushing " have been reported by Okulicev (1934) who states that the practice decreased the number of barren ewes and it increased the percentage of multibirths; while the number of lambs per 100 ewes was 103 in the control group, the " flushed " groups gave 120, 112, and 110 lambs.

Nichols (1926) is of the opinion that the manner in which the " flush " is produced is not as important as the fact that there has been " flushing " or a change to good fresh pasture. Nichols considers it imperative to practice " flushing " every year, for, if this is not done, lambing results are likely to fall below the normal.

Grant (1934) believes that " flushing " hastens the onset of the breeding season by converting the spurious ovulation periods into true " heat " periods, but he cannot agree that it stimulates earlier production of ripe follicles. Grant contends that " flushing " to be effective must be commenced at least 5 or 6 weeks before the first oestrus is due to occur.

Asdell (1926) cannot agree that increase in feed can be the decisive factor in most animals in determining whether the onset of the sexual season will be early or late, although he considers that the feed supply is certain to have a large influence where the animals are bordering on starvation. The remarks of Clark (1934) appear to agree in principle with the contentions of Asdell.

The effects of mal-nutrition upon the reproductive powers of animals have received some attention; controlled experimentation supports the general contention that underfeeding impairs reproduction.

Observations on laboratory animals indicate that, under conditions of mal-nutrition, the normal functions of the ovaries are affected Leob (1917, *cit.* Marshall, 1922) found that, when guinea-pigs were underfed, maturation is prevented and atrophy takes place; similar treatment in the case of young animals has more marked effects. These results were confirmed by Papanicolaou and Stockard (1920); a prolongation of the dioestrum and a congestion in the uterus and ovary are reported, while the larger follicles were found to be more unfavourably affected by the lack of proper feed.

Marshall and Hammond (1925) consider that mal-nutrition in sheep leads to an increased atrophy of Graafian follicles, which, if excessive, may cause the animals to become sterile for one or more seasons.

Du Toit and Bisschop (1929) give very interesting results in the case of bovines run on mineral-deficient South African veld. When the pasture was balanced by the feeding of bonemeal, 66·1 per cent. of the 109 cows had three calves during three years, whereas none of the 20 controls had three calves during that period. The cows receiving the supplementary mineral in bonemeal produced 87·3 per cent of the possible number of calves, while the equivalent percentage of the control group was 56·5. The authors state that the cows which received bonemeal bred with greater regularity and that cows on deficient pasture exhausted their mineral reserves in the process of gestation and, generally, they needed two or more seasons in order to build up such reserves. Moreover, bonemeal-fed calves out of bonemeal-fed cows, bred earlier in life than did non-bonemeal fed calves out of control cows.

Bekker (1932) has demonstrated the detrimental effects upon reproduction when sheep from phosphorus deficient veld are maintained on a phosphorus deficient ration and that improvement is reflected by adding bonemeal to the ration.

There appears to be some doubt as to whether phosphorus deficiency is the only or the main short-coming in areas where mineral deficiencies are marked. The recent observations of Eckles, Palmer, *et al.* (1935) indicate that irregularities in sexual activity and breeding efficiency are more likely to be due to complicated nutritive deficiencies and not merely to the lack of phosphorus. It was observed that uncomplicated phosphorus deficiency did not cause abnormal oestrous cycles in dairy cows, although such rations did reduce breeding efficiency. The authors reviewed the results of various workers: Hart and Gilbert (1928) consider that the failure of range cows to conceive is in part due to restricted calcium and phosphorus intake, but the lack of protein is also recognised. Gilbert and Hart (1930) found that sexually mature rats on low phosphorus diets showed 80 per cent. cessation of oestrus and 100 per cent. young rats failed to reach sexual maturity on such diets, but it was indicated that the adverse effects were due not merely to phosphorus deficiency,

but rather to an abnormally high Ca/P. ratio coupled with low phosphorus intake. Evans and Bishop (1922) demonstrated that protein deficiency decreases the percentage of normal oestrous cycles in rats and that vitamin A deficiency affects the ovulation rhythm. In connection with pasture deficiencies, Hart, Guilbert, and Goss (1932) consider that vitamin A factor may be of considerable importance. However, Theiler (1933) is of the opinion that calcium and vitamin deficiencies are not important factors affecting the fertility of range cattle in phosphorus deficient areas in South Africa, but Hart and Guilbert (1933) considering the symptoms, contend that the lack of vitamin A should have been considered as an important factor of deficiency.

THE PHYSIOGRAPHICAL CONDITIONS UNDER WHICH THE REPORTED OBSERVATIONS WERE MADE.

The experiments were conducted at the Veterinary Research Station, Ermelo, Transvaal. Ermelo is 5,690 feet above sea level. The topography of the district is undulating. The Research Station is located two and a half miles west of Ermelo town. The area of the Research Station is 2,400 acres, which is divided systematically into small camps to permit grazing control. In general, the physiographical conditions of the Research Station may be considered to be fairly representative of a large portion of the eastern Transvaal highveld.

Meteorological Data.

The monthly rainfalls and temperatures of the years during which the experiments reported here were conducted, are given in Table I and illustrated in Diagram 1.

It is apparent from the meteorological records that the rainfall is heaviest during January, February, November, and December; approximately 70 per cent. of the annual rainfall occurs during these months. Although the autumn and winter months are often without rain, very frequently a few inches of rain are recorded. Early spring rains may be expected during August or September. The rainy months are also the hottest months. Very low temperatures are experienced during the winter months. As the accompanying diagram indicates, temperatures are often erratic and frequently comparatively low temperatures are experienced during the autumn and spring seasons.

The Soils.

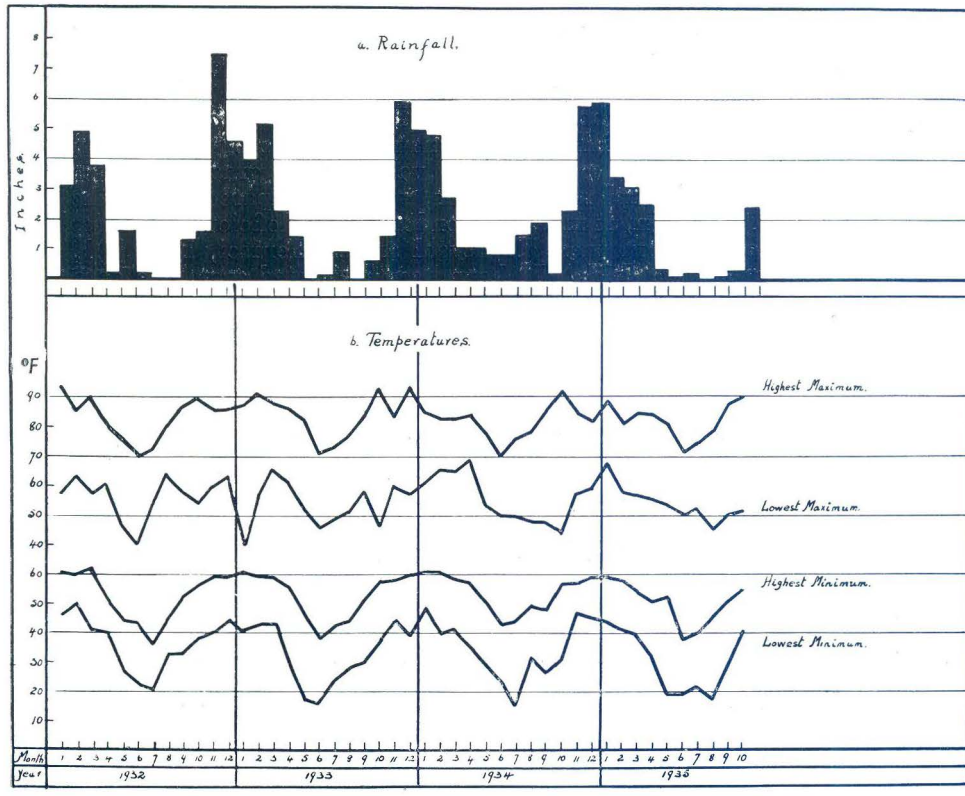
The mineral contents of the main types of soils found on the Research Station have been determined by Henrici [1930 (*a*)] from whose table of results certain data have been extracted and these are presented in Table II.

TABLE I.

Rainfall and Temperature Records: Ermelo.

Year	1932.					1933.					1934.					1935.				
Month.	Total rainfall.	Highest max.	Lowest max.	Highest min.	Lowest min.	Total rainfall.	Highest max.	Lowest max.	Highest min.	Lowest min.	Total rainfall.	Highest max.	Lowest max.	Highest min.	Lowest min.	Total rainfall.	Highest max.	Lowest max.	Highest min.	Lowest min.
	Ins.	°F.	°F.	°F.	°F.	Ins.	°F.	°F.	°F.	°F.	Ins.	°F.	°F.	°F.	°F.	Ins.	°F.	°F.	°F.	°F.
January	3·06	93·6	58·0	61·0	46·0	3·99	86·8	40·2	61·0	40·3	4·76	85·0	61·4	61·4	49·4	3·41	89·0	68·0	59·0	44·0
February	4·87	84·8	63·5	59·8	50·0	5·19	91·2	57·4	58·6	42·8	2·68	82·8	66·3	61·0	40·3	3·07	81·0	58·0	58·0	41·0
March	3·79	90·0	56·6	62·0	41·4	2·28	88·0	66·4	59·0	43·0	0·98	82·9	65·3	58·9	42·5	2·54	85·0	57·0	54·0	39·0
April	0·17	81·0	61·2	51·3	40·0	1·37	85·8	62·2	55·8	29·6	1·02	84·0	69·0	57·0	35·0	0·26	84·0	56·0	51·0	32·0
May	1·64	75·2	47·3	44·0	27·4	0·01	81·8	51·9	46·4	17·2	0·83	78·0	54·0	51·0	30·0	0·06	81·0	54·0	52·0	19·0
June	0·25	69·5	40·3	43·3	22·0	0·12	71·3	45·0	39·3	15·3	0·83	70·0	50·0	43·0	24·0	0·20	71·0	50·0	38·0	19·0
July	0·00	71·5	52·0	36·0	20·3	0·91	73·2	48·6	43·2	23·2	1·50	76·0	50·0	44·0	15·0	0·03	75·0	53·0	40·0	22·0
August	0·00	79·8	63·8	43·6	32·3	0·01	77·4	50·8	44·3	27·5	1·90	78·0	48·0	49·0	31·0	0·10	79·0	45·0	45·0	17·0
September	1·32	87·3	58·2	52·0	33·0	0·56	84·1	57·9	51·9	29·5	0·16	86·0	48·0	48·0	27·0	0·30	88·0	51·0	51·0	29·0
October	1·62	89·5	53·8	56·3	38·0	1·44	92·7	45·5	58·4	37·0	2·31	92·0	44·0	57·0	31·0	2·38	91·0	52·0	55·0	41·0
November	7·46	86·4	59·6	59·2	39·8	5·91	82·9	60·5	58·0	44·0	5·76	85·0	58·0	57·0	47·0	—	—	—	—	—
December	4·55	86·4	64·3	59·0	44·5	5·03	92·6	57·1	59·5	39·0	5·86	82·0	59·0	59·0	45·0	—	—	—	—	—
TOTALS	28·73	—	—	—	—	26·82	—	—	—	—	28·59	—	—	—	—	—	—	—	—	—

DIAGRAM 1.



Rainfall and Temperature Records, Ermelo.

TABLE II.

Soils of Nooitgedacht, 10, Ermelo District, Transvaal.

[Henrici, 1930 (*a*).]

	Grey soil.	Dark brown soil.	Black soil.	Red sandy soil.
	Per cent.	Per cent.	Per cent.	Per cent.
CaO	0·05	0·06	0·70	0·07
MgO	0·08	0·08	0·82	0·14
K_2O	0·15	0·27	0·12	0·12
P_2O_5	0·03	0·03	0·03	0·07
Nitrogen	0·078	0·193	0·084	0·090
Available K_2O	0·012	0·007	0·0035	0·0131
„ P_2O_5	0·001	0·002	0·0012	0·0007
„ CaO	0·010	0·016	0·326	0·046
„ MgO	0·009	0·010	0·152	0·027
P.H. value	5·2	5·1	—	—

It is seen that most of the above soils have a low mineral content and that all the soils are poor in available phosphorus.

The Pasture.

Although many varieties of grasses are found in the natural pasture, *Themedra triandra* is the characteristic grass of the area, and it appears that a very mixed grass vegetation with little *Themedra* occurs only on the poorer soils [Henrici, 1930 (*a*)]. In spite of a relatively high rainfall, the dominating grasses of the eastern Transvaal never have the same feeding value as the grasses of drier areas such as Bechuanaland, whereas, when compared with the grasses of Great Britain, it must be wondered that deficiency diseases are not more common in these Transvaal areas [Henrici, 1930 (*b*)]. The data presented in Table III have been extracted from the data determined by Hendrici, [1930 (*a*)] upon analyses of grasses on the Research Station.

Table III.

Ash and Protein Content of Themedra triandra *in Percentage of Stove Dry Matter.*

Date of sampling.	Organ.	Ash.	Crude protein.	Crude fibre.	CaO.	MgO	Na_2O.	K_2O.	P_2O_5.	Cl.
27. 4.26	Green leaves.....	—	4·9	29·71	0·30	0·33	0·007	0·80	0·183	—
21. 8.26	Brown „	10·88	2·6	—	0·35	0·23	—	—	0·084	0·088
3. 2.28	Green „	9·7	5·74	—	0·42	0·23	0·044	1·98	0·264	0·286
26. 4.28	Green „	7·87	5·9	—	0·47	0·30	0·044	1·98	0·404	0·540
30. 7.28	Brown „	9·31	2·78	—	0·36	0·25	trace	—	0·159	0·000
2.11.28	Green „	8·84	8·57	—	0·51	0·37	0·008	1·42	0·388	0·682

The researches of Henrici [1930 (*a*); 1930 (*b*)] reveal that, with the sole exception of potassium, the minerals important for the sustinance of animal life are deficient in the dominating grasses for the greater part of the year; for only a short time in spring the grasses may be said to be good. Even in January, regardless of rains, the grasses appear to reach a latent stage, but strangely enough recover in February and March by a new type of secondary growth. During the autumn months, the feed value leaches from the plants. The length of the period during winter months when green leaves are entirely absent varies from 30 to 120 days depending upon the climatic conditions and especially the rainfall.

The Methods of Sheep Husbandry.

The above physiographical conditions necessitate very particular management if sheep farming is to be a success.

During the summer months, healthy sheep attain good condition, but sheep begin to lose condition in the autumn and the loss of weight during the winter months depends upon the severity of the season and the management afforded.

The feeding of mineral licks is essential, although, it may be added, many farmers do not appreciate this fact. Various combinations usually consisting at least of bonemeal and salt are fed. When licks are self-fed throughout the year, sheep consume larger quantities during the winter months.

In the great majority of cases, it is necessary to supply supplementary feed during the winter months. Some farmers trek with all or most of their sheep to the low veld, where better winter grazing is available. When sheep are wintered on the highveld, the supplementary feeds used are maize and green cereal grazing. The extent of feeding necessary depends upon: the quality and quantity of the available natural pasture, and the type of sheep (old or young, pregnant or non-pregnant, lactating or dry). While a large percentage of dry sheep may be carried through the winter on maize feeding, young sheep up to the age of 18 months, and pregnant and lactating ewes require green grazing for a portion of the winter at least. Provided grain feeding is started before the sheep have lost heavily in condition, from 4 to 6 ounces of maize should assist in maintaining a satisfactory winter weight.

High temperatures and rainfall during the summer months are favourable conditions for internal parasites. When sheep are kept on low-lying pastures, clean drinking water is not supplied, and worm control is not practised, no success with sheep may be expected. The control of internal parasites is essential especially during the first twelve months of the sheep's life.

Due to the difficulty of rearing a satisfactory percentage of healthy sheep, autumn lambing is preferred to spring lambing, as lambs born during the autumn are well advanced when worm infection is likely to be at its worst. Some farmers practice both autumn and spring lambing, but there appears to be some doubt as to whether all ewes can be made to lamb during the former season.

The above conditions were borne in mind when the experiments reported here were planned and the experience in handling the Research Station's available flock was, to some extent, a guide in selecting the rations for the experimental groups.

PART I.

SEX PHYSIOLOGY OF THE NON-PREGNANT EWE.

The various phases of the study are presented as separate experiments.

Certain experiments, and, in certain instances, portions of the same experiment, were commenced at a later date than others. This was necessitated partly by the unavailibility of sufficient sheep material, and also by the difficulty of accommodating very large numbers of sheep in the feed-yards and on suitable representative grazing near the yards. On the other hand, certain additions to the studies were suggested as the investigations progressed.

EXPERIMENT 1.

THE INFLUENCE OF NUTRITION UPON THE SEXUAL ACTIVITY OF NON-PREGNANT MERINO EWES.

Küpfer's (1928) observations on Merino sheep under western Free State (South Africa) conditions, reveal the existance of restricted annual sexual activity in that breed, and he considers that, as Merinos in Australia (Marshall, 1922) and the sheep of Central Europe (Küpfer, 1928) experience unrestricted annual sexual activity, sheep under South African conditions have adapted their ovarian functions to the environment. In other words, the short period of sexual activity of sheep under South African conditions is an adaptation to the conditions necessary for the rearing of the offspring.

The observations of Quinlan and Maré (1931) under Karroo (South Africa) conditions, do not confirm those of Küpfer (1928), in that the former authors observed continuous annual sexual activity in Merino sheep, although it is stated that the absence of rain for extended periods adversely effects the grazing and results in irregularity of the dioestrous cycles. These authors are of the opinion that Küpfer's observations must have been made during an exceptional year when sexual activity was particularly low.

Preliminary observations made by the author at the Research Station, Ermelo, confirmed the findings of Küpfer (1928); Merino sheep under eastern Transvaal conditions exhibit restricted annual sexual activity.

The physiographical conditions of the eastern districts of the Transvaal have been discussed in a previous section. Evidence has been given to indicate that the poor fertility of the soil and the low nutritive value of the pastures do not permit these districts to be classed as good sheep country. The reproductive functions of animals were, therefore, suspected to be restricted by factors largely of a nutritional nature.

The liberal feeding of bone meal licks to stock has, for some time, been accepted as an essential farm practice. Sheep kept solely on natural pasture in these areas are unable to maintain normal health; general weakness and anaemia set in and a comparatively large percentage are likely to die during poor seasons. Long severe winters necessitate supplementary feeding; generally maize is fed but cereal winter grazing may be provided, and, during prolonged droughts, teff hay may be used. The feeding of protein-rich concentrates has not received consideration due to the high prices demanded for such feeds.

The object of this experiment was to study the effects of various levels of feeding and different combinations of feeds upon the sexual activity of Merino ewes which are subjected to such treatment for prolonged periods of time.

Materials and Methods.—The sheep used in the experiment were obtained from the Research Station's available flock of Merinos, which is classed annually according to the recognized standards of Merino flock classing, so that the material, which was taken at random from the flock, may be considered representative of a commercial flock. Eighty sheep were used for the observations in Experiment 1A and 50 in Experiment 1B.

In the formation of the groups for any phase of the experiment, the sheep were divided proportionately with respect to age, type, and weight.

All weight records were taken at 14 day intervals after 12 to 14 hours starvation; the sheep were kept in a covered shed at night and weighing was done between 6 and 8 a.m. the next morning.

All the groups were tested for oestrus daily between 6 and 8 a.m., this work was supervised by the stockman assisted by a native. Four to six vasectomised teasers were used with 10 ewes; the former were kept moving among the ewes for 7 to 10 minutes at each testing.

In the case of the dry-lot or non-pasture groups, open yards measuring 8×16 yards and devoid of pasture were used; the yards were supplied with hay racks and feed, water, and lick troughs. No grazing was permitted; the sheep left the yards only for fortnightly weighings and the annual shearing. A certain amount of shelter was afforded by tree wind-breaks. Concentrate rations were fed once daily, roughage twice daily, and the licks and water were available at all times.

The groups on natural pasture were grazed on suitable camps near the observation yards; clean trough water and the mineral licks were available in the camps. The groups were brought to the yards daily between 6 a.m. and 8 a.m. for oestrous observations, and at this time certain groups received their supplementary feed according to the plan of the experiment; the latter groups were drafted out by means of a drafting race.

All the concentrates and licks fed were purchased. The teff hay fed was grown on the Research Station; the quality of the hay was good.

All sheep, in the dry-lots and grazing groups received treatment for gastric and intestinal parasites at 28 day intervals throughout the year. Government Wireworm Remedy was used.

The annual inoculation against Bluetongue took place three weeks prior to shearing. The first dipping in an arsenical preparation for the control of keds was given approximately one month after shearing.

The deaths that occurred in the various groups cannot be said to have been due to the treatment to which the sheep were subjected.

Experiment 1A.

Low Planes of Nutrition in Dry-lot compared to Supplemented Pasture.

The experiment was commenced in July, 1932. At this stage of winter, it was found necessary to start supplementary feeding of the Research Station's general flock; the condition of the sheep was therefore, at a winter level.

Previous experience of the Station's pasture had indicated that non-pregnant Merino sheep on dry winter pasture required from 4 to 5 ounces of maize per sheep per day as supplementary feed, and it was estimated that a sheep consumed between 2 and 3 pounds of dry roughage a day. The rations of the dry-lot fed groups were constructed on this basis.

A general outline of the treatments of the groups in this portion of the experiment is given in Table I.

TABLE I.

Groups in Experiment 1A.

Group.	No. of sheep.	Observations commenced.	Treatment.
I	10	24.7.32	Dry-lot: Maize, teff hay, bone meal, and salt.
II	10	24.7.32	Dry-lot: Maize, teff hay, and salt.
III	10	24.7.32	Dry-lot: Maize, cotton seed meal, teff hay, and salt.
IV	10	(1) 24.7.32 (2) 2.3.33	Dry-lot: Maize, teff hay, bone meal, and salt Dry-lot: Teff hay, bone meal, and salt.
V	10	24.7.32	Dry-lot: Maize, teff hay, bone meal, and salt.
VI	10	7.10.32	Pasture: Bone meal and salt.
VII	10	7.10.32	Pasture: Maize, bone meal, and salt.
VIII	10	1.5.33	Pasture: Bone meal and salt, and green oat grazing during winter months.

The sheep of Groups I to IV were approximately 22 months old at the commencement of the experiment. As it was suspected that young ewes might be irregular with regard to sexual activity, Group V, consisting of mature ewes, was included. It will be seen that the maize ration of the latter group is an ounce more than that of Group I with which comparisons are to be made. The initial mean weights of the two groups necessitated this difference in the rations.

The treatment of Group IV during the first period of 224 days was similar to that of Group I, but the former group was subjected to a lower plane of nutrition during the second period of 520 days; the alteration in the ration was made at a time when the sheep were exhibiting normal sexual activity.

Group VII was fed maize according to appetite; the consumption varied from 8 to 12 ounces per sheep per day according to the nature of the natural pasture.

Group VIII was drafted on to green oat grazing for one to two hours daily during the periods when natural green pasture was not available. During the winter months of 1933 the oat grazing was not entirely satisfactory, due to adverse weather conditions, but during the 1934 winter months the green cereal grazing was good.

The quantities of feed and lick consumed are given in Table V of the next section.

Results.

The general treatments of Groups I to VIII have been indicated in Table IV of the text. The details of the feed schedule and the quantities of lick consumed are presented in Table II.

With regard to Table II, attention is drawn to the following points: (1)The rations of the dry-lot fed groups remained constant. As the licks were self-fed, the quantities issued were recorded; the above quantities have been computed from the records of the issues.

(2) Group VII was fed maize at the rate of 8 ounces per sheep per day when pastures were good, but, for approximately 90 days during each of the two winter seasons, the daily consumption per sheep was 12 ounces.

(3) The winter period during which Group VIII was given green oat grazing was approximately 90 days.

(4) The impossibility of feeding lick to each of the pasture groups separately necessitates considering an average figure for the groups on pasture.

The weights of individual sheep in Groups I to VIII, which were taken at 14 day intervals, are given in Appendix 1A, Tables I to VIII. The mean weights of the groups at each period are given and these have been used for the construction of Diagram 2A of the text, which illustrates the tendencies of the weights of the respective groups throughout the experiment. Alterations in the numbers of sheep in the groups are indicated in brackets at points on the curves when reductions occurred.

The records of the observations of oestrus of individual sheep are given in Appendix 1A, Tables IX to XVI, from which Tables XVII to XXIV of the appendix have been compiled in order to reflect the seasonal sexual activity and the periodicity of oestrus of the individuals of each group.

TABLE II.

Rations of Groups.

Group.	No. of sheep.	Period.	Type of treatment.	Rations consumed per sheep per 100 days.				
				Maize.	Cotton-seed meal.	Teff hay.	Bone meal.	Salt.
		days.		lb.	lb.	lb.	lb.	lb.
I	10	744	Dry-lot.	25	—	250	2·60	1·3
II	10	744	,,	25	—	250	—	1·8
III (*a*)	10	126	,,	16·9	8·1	250	—	1·9
(*b*)	9	618	,,	16·9	8·1	250	—	1·6
Average (*a*) and (*b*)	—	744	,,	16·9	8·1	250	—	1·75
IV 1st period	10	244	,,	25	—	250	1·65	0·82
2nd period (*a*)	10	329	,,	—	—	300	1·69	0·85
(*b*)	9	191	,,	—	—	300	2·61	1·30
Average (*a*) and (*b*)	—	520	,,	—	—	300	2·15	1·08
V (*a*)	10	367	,,	31·25	—	250	1·29	0·64
(*b*)	9	154	,,	31·25	—	250	1·01	0·50
(*c*)	7	223	,,	31·25	—	250	1·60	0·80
Average (*a*), (*b*) and (*c*)	—	744	,,	31·25	—	250	1·30	0·65
VI (*a*)	10	350	Pasture	—	—	—	2·32	1·16
(*b*)	9	408	,,	—	—	—	2·32	1·16
Average (*a*) and (*b*)	—	758	,,	—	—	—	2·32	1·16
VII (*a*)	10	578	,,	50·0	—	—	2·32	1·16
(*b*)	10	180	,,	75·0	—	—	2·32	1·16
Average (*a*) and (*b*)	—	758	,,	62·5	—	—	2·32	1·16
VIII (*a*)	10	369	,,	—	—	—	2·32	1·16
(*b*)	10	180	Pasture and oat grazing	—	—	—	2·32	1·16
Average (*a*) and (*b*)	—	549	,,	—	—	—	2·32	1·16

It will be observed that dates of slaughter are given in the former tables. The sheep were slaughtered for the examination of the ovaries the reports of which are given in this thesis (Experiment 2: The Morphology of the Ovaries of Merino Sheep during Anoestrum).

Table XXV of Appendix 1A has been constructed from Tables XVII to XXIV in order to obtain the frequencies of the periodicity of oestrus of each of the eight groups.

The following Table III of the text has been compiled from Tables XVII to XXIV of Appendix 1A, in order to permit a comparison of the groups with respect to sexual activity.

An analysis of the periodicity of oestrus made from Table XXV of Appendix 1A is given in Table IV of the text; the two complete sexual seasons of 1933 and 1934 have been considered in the analysis.

The effects of the various treatments upon the wool growth are, to an extent, unrelated to the main purpose of the experiment, but, as the Merino is primarily a wool producing sheep, the shearing results recorded ,although not complete from a wool specialist's point of view, cannot be considered entirely irrevelant to the present study. It was thought that the collection of shearing results might suggest nutritional problems relative to wool growth. The shearing data of the groups have been presented in average figures in Table V of the text. It must be pointed out that, in the case of Groups I to V, only four months of wool growths shorn in 1932 were grown under experimental conditions; in the case of Groups VI and VII, the sheep were drafted into the experiment one month before the 1932 shearing; while, in the case of Group VIII, the sheep were in the experiment for seven months before the 1933 shearing took place.

Photographs of the eight groups of sheep are given in Figs. 1-16.

Discussion.

Few observations upon the sexual activity of sheep have been of long duration; studies with Merino sheep have been continued over periods of 6 and 7 months only (Küpfer, 1928; Quinlan and Maré, 1931).

Little or no attention has been paid to the condition or body weight of sheep in relation to ovarian activity; generally, regular or irregular sexual activity is attributed to good or bad seasons respectively. In sheep husbandry, it is contended that ewes should " pick up " in weight some weeks prior to the mating period, and the practice of " flushing " sheep in order to increase ovarian activity and consequently fertility, is considered to be effective (Marshall, 1903, 1922; Potts, 1924; Marshal and Hammond, 1926). In this connection, the opinion of Asdell (1926) is interesting: He contends that increase of feed is not a decisive factor, although feed supply is certain to have a large influence where the animals are bordering on starvation. The remarks of Clark (1934) appear to agree in principle with those of Asdell.

TABLE III.

The Sexual Seasons.

Group.	Sexual Season, 1932 (*a*).			Anoestrous Period, 1932–1933.			Sexual Season, 1933.				
	No. of sheep.	No. of sheep exhibiting oestrus.	Total No. of dioestrous cycles.	No. of sheep.	Duration.		No. of sheep.	No. of sheep exhibiting oestrus.	Mean No. of dioestrous cycles.	Duration.	
					Range.	Mean.				Range.	Mean.
					days.	days.				days.	days.
I.....	10	2	4	10	182–235	209·5	10	10	8·1	58–217	136·1
II.....	10	1	1	10	172·248	213·6	10	10	6·9	1–207	120·0
III.....	10	0	0	9	199–273	228·0	9	9	4·2	1–163	84·7
IV.....	10	4	7	10	129–218	189·2	10	10	8·9	36–227	158·5
V.....	10	10	28	10	68–210	129·7	9	9	10·7	137–289	217·6
VI.....	—	—	—	10	125–157	139·7	10	10	8·8	107–196	154·0
VII.....	—	—	—	10	99–180	133·1	10	10	8·9	99–246	179·3
VIII.....	—	—	—	—	—	—	10	10	6·1	36–138	91·9(*b*)

Group.	Anoestrous Period, 1933–34.			Sexual Period, 1934.					Anoestrous Period, 1934–1935 (*a*).	
	No. of sheep.	Duration.		No. of sheep.	No. of sheep exhibiting oestrus.	Mean No. of dioestrous cycles.	Duration.		No. of sheep.	Range of period of duration from end of sexual season to date of slaughter.
		Range.	Mean.				Range.	Mean.		
		days.	days.				days.	days.		days.
I.....	10	201–389	276·6	10	9	5·8	21–286	118·1	10	0–154
II.....	10	211–458	294·4	10	9	4·7	35–174	117·2	10	92–164
III.....	9	250–443	333·3	9	8	3·2	1–142	62·9	9	57–161
IV.....	9	125–353	298·8	9	7	2·9	1–117	43·0	9	66–204
V.....	7	178–411	269·4	7	5	7·4	62–185	101·6	7	52–156
VI.....	9	118–341	204·4	9	9	9·2	102–244	183·2	9	68–198
VII.....	10	107–404	180·4	10	10	9·3	1–291	139·1	10	32–122
VIII.....	10	107–231	164·9	10	10	13·3	154–280	230·4	10	38–163

NOTE :—

(*a*) As observations were commenced at the end of the first sexual season (1932) and observations were terminated before the end of the last anoestrous period (1934–1935) by slaughtering, these periods are incomplete, and they are, therefore, not presented in detail similar to that of the intermediate periods.

(*b*) In the case of Group VIII, oestrous observations were commenced on 1.5.33 or about three months after the commencement of the sexual season, 1933.

(*c*) Incomplete periods due to death have not been considered when computing the mean values.

(*d*) The mean duration of the sexual season has been computed by considering only the number showing oestrus, so that sheep present in a group which did not show oestrus have not been considered in the calculations.

TABLE IV.

The Periodicity of Oestrus.

Group.	Sexual Season, 1933.				Sexual Season, 1934.				Sexual Seasons, 1933 and 1934.		
	No. of sheep.	Total number of inter-oestrous periods.	Range of periods after which oestrus recurred.	Percentage cases in which oestrus recurred after a period of 16–19 days (*a*).	No. of sheep.	Total number of inter-oestrous periods.	Range of periods after which oestrus recurred.	Percentage cases in which oestrus recurred after a period of 16–19 days.	Total number of inter-oestrous periods.	Range of periods after which oestrus recurred.	Percentage cases in which oestrus recurred after a period of 16–19 days.
			days.	per cent.			days.	per cent.		days.	per cent.
I.....	10	71	15–82	90·1	10	49	12–72	79·6	120	12–82	84·8
II.....	10	59	15–52	83·0	10	38	16–157	71·0	97	15–157	77·0
III.....	9	29	15–66	55·2	9	18	16–54	50·0	47	15–66	52·6
IV.....	10	79	15–57	83·5	9	13	16–67	84·6	92	15–67	84·0
V.....	9	89	16–68	77·5	7	32	15–145	75·0	121	15–145	76·2
VI.....	10	78	16–36	85·9	9	73	16–100	79·4	151	16–100	82·6
VII.....	10	79	15–105	81·0	10	83	13–84	74·7	162	13–105	77·8
VIII.....	10	51 (*b*)	15–37	90·2	10	122	15–46	91·0	173	15–46	90·6

*NOTE.—(*a*) In a very small percentage of cases oestrus recurs after 15, 20, 21 or even 22 days. For the present purpose the period 16 to 19 days may be considered the normal period after which oestrus recurs.

(*b*) In the case of Group VIII oestrous observations were commenced during the sexual season 1933.

TABLE V.

Shearing Data.

Group.	Average grease wool yields (lb.).			No. of sound fleeces.			Average fleece lengths (inches).		
	1932.	1933.	1934.	1932.	1933.	1934.	1932.	1933.	1934.
I.....	7·5 (10)	7·9 (10)	5·6 (4)	9	8	3	—	2·35	2·50
II.....	7·8 (10)	4·9 (5)	4·9 (5)	8	8	5	—	2·40	2·10
III.....	8·4 (10)	8·7 (9)	— (0)	10	9	—	—	2·60	—
VI.....	7·0 (10)	6·2 (10)	— (0)	8	10	—	2·42	2·40	—
V.....	7·6 (9)	6·6 (8)	4·6 (4)	9	7	4	—	2·20	1·50
VI.....	7·9 (10)	7·8 (9)	5·8 (9)	6	7	8	—	2·30	1·90
VII.....	8·2 (10)	10·3 (10)	7·0 (8)	8	10	8	—	2·68	2·34
VIII.....	—	9·4 (10)	7·2 (10)	—	10	5	—	2·48	2·00

NOTE.—(*a*) The numerals in brackets under the heading " Grease wool yields," indicate the number of sheep in the groups at the particular annual shearing. These numbers are not repeated in the remaining columns.

(*b*) As many sheep were slaughtered prior to the 1934 shearing, the numbers in certain groups are considerably reduced.

Researches upon laboratory animals indicate that deficient rations affect the normal cyclical changes in the ovary (Leob, 1917, *cit.* Marshall, 1922); Papanicolaou and Stockard, 1920; Evans and Bischop, 1922; Gilbert and Hart, 1930). Du Toit and Bisschop (1929) have observed reduced fertility in cattle, and Bekker (1932) in sheep, in phosphorus deficient areas. Eckles, Palmer, *et al.* (1935) consider that irregularities in sexual activity are due not alone to phosphorus deficiency, but to more complex nutritive deficiencies. These authors found that, in dairy cattle, uncomplicated phosphorus deficient rations do not cause abnormal oestrous cycles, although such rations do reduce the breeding efficiency. The following appear to be the most important considerations in deficient rations: low phosphorus, high Ca/P ration coupled with low phosphorus, low protein, and lack of vitamins.

The observations reported in this experiment were conducted over periods of from 549 to 744 days.

Unfortunately, data upon the digestible nutrients of South African feed-stuffs are not obtainable, so that a detailed reflection of feed nutrients available to the groups of sheep under controlled feeding cannot be given. It would be incorrect to compute the nutritive values of the particular rations upon the basis of such standards as that of Henry and Morrison (1923), and to compare the quantities obtained with those considered to be the requirements of "fine wool sheep". The composition of American and South African feed-stuffs vary considerably (Vipond, 1914), and animals under such vastly different conditions may be expected to differ in their nutritional requirements. However, Table XXVI of Appendix 1A gives the analyses of the feeding-stuffs used in this and other experiments reported upon in this thesis.

The growth curves in Diagram 2A., constructed on the mean weights, illustrate the ability of the rations of Groups I to IV to maintain the weights of the sheep at a level approximating those at the commencement of the experiment. It has been explained that the latter weight was a winter weight, one at which, under practical conditions, supplementary feeding of sheep on veld should commence.

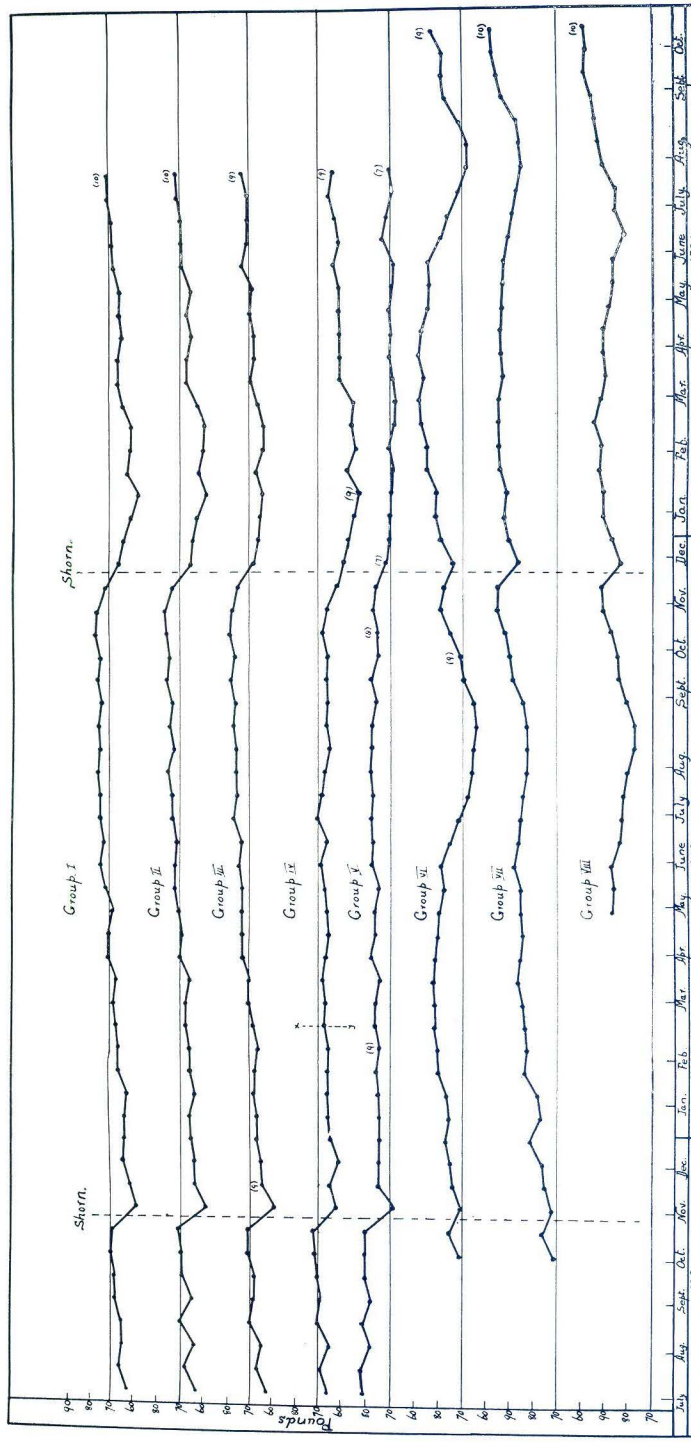
With the exception of Group IV, there is an insignificant difference between the mean weights just prior to shearing in 1932 and 1933. This is also true of the post-shearing weights of those years. It is evident, therefore, that the slight upward trend of the curves is due to wool growth. In Group IV there is a greater tendency to maintain weight in spite of wool growth, hence body weight could not have increased during that period.

Groups I to IV show a decrease in weight just prior to the 1933 shearing. This is considered to be the effect of inoculation upon sheep maintained at a low level weight for an extended period. The decrease is more marked among the weakest sheep of Group IV.

After the 1934 shearing, Groups I to IV show more reluctance to recover weight than was the case during the equivalent time of the previous year. Again, this is more marked in the case of Group IV.

DIAGRAM 2A.

EXPERIMENT 1A.



Mean weights of groups at 14 days intervals.

The three curves of Groups I, II, and III are almost parallel and, considering the rations of these groups (Table II), it may be said that the addition of bonemeal to the salt lick and the inclusion of a protein rich concentrate in the ration, reflects no improvement in body weight when a low level ration of maize, teff hay, and salt lick are fed. On the other hand, the removal of the maize from a low level ration of maize, teff hay, bone meal, and salt, as in Group IV, eliminates the gradual increase evidenced in the preceding groups (Diagram 2A, *x-y*); the graph of the former group tends to remain horizontal

The older sheep in Group V, on a similar ration to that of Group I, show great consistency in weight, and there is evidence that wool production in such sheep suffers, possibly in order that the reduced body weight may be maintained (Table V).

The weight curves of the veld Groups VI, VII, and VIII, reflect the reaction of the sheep to the altered conditions of the seasons.

The impossibility of having a control group in the true sense of the term has been explained. Group VI on veld supplemented throughout the year only with a mineral lick of two parts of bone meal and one part of salt, must be accepted as a control. Group VI attains its highest summer weight during February and March and it drops to its lowest winter weight during August. The losses in mean weight during the two years are 22·2 and 25·3 per cent. of the highest mean summer weights. The mean highest summer weight during the better season (1934) is 6 pounds greater than that of the preceding season.

The effects of feeding a supplementary ration of maize throughout the year are reflected in the weight curve of Group VII. In this case, the differences between the highest summer and lowest winter mean weights are 5·8 and 10·7 per cent. of the former.

Supplying green cereal grazing when natural green grazing is no longer available, does not entirely eliminate the reaction to winter conditions. Hence, in the case of Group VIII, the differences between the highest summer and lowest winter mean weights are 11·6 and 15·0 per cent. of the former.

With regard to the above computations of summer and winter differences, it must be pointed out that the increase of wool weight during the period of about 6 months which amounts to from 3 to 5 pounds (Table V), has not been considered.

The mean weights of Groups I to VIII at critical periods are given in Table VI of the text.

The critical periods are those at which the mean weights of the veld groups are highest (during February and March) and lowest (during July and August). In the non-veld or dry-lot fed groups, these seasonal differences are not apparent; in these cases differences in weight are due to wool growth. The weights at the critical periods are of particular interest in connection with seasonal activity and reference will be made to these weights in subsequent discussions.

Table VI.

Mean Weights at Critical Periods.

Group.	1932.		1933.				1934.			
	July, 22.	Aug., 20.	Feb., 1.	Mar., 30.	July, 21.	Aug., 31.	Feb., 1.	Mar., 16.	July, 21.	Aug., 18.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
I.....	61·4	63·2	65·0	66·1	72·4	73·2	61·4	62·1	68·7	67·4
II.....	61·4	62·4	64·3	64·6	71·6	72·8	59·0	60·6	68·7	67·3
III.....	61·2	63·4	66·8	69·6	73·4	75·2	64·9	64·4	68·9	69·3
IV.....	65·6	64·9	65·5	68·0	67·2	65·9	56·3	63·6	63·7	59·2
V.....	80·4	77·4	75·7	73·9	76·3	76·6	69·9	67·1	67·8	66·9
VI.....	—	—	80·4	82·2	67·4	63·3	83·8	87·4	69·4	64·8
VII.....	—	—	83·4	86·2	82·8	82·3	92·8	93·0	83·6	82·6
VIII.....	—	—	—	—	81·4	75·6	91·4	90·0	83·4	89·5

In Groups I to V, oestrous observations were commenced during the latter part of the sexual season of 1932, in Groups VI and VII approximately 5 weeks after the termination of the sexual season of 1932, and in Group VIII approximately three months after the commencement of the sexual season of 1933 (Appendix 1A, Tables IX to XVI and Tables XVII to XXIV). Oestrous observations in all groups terminated during the anoestrous period of 1934-1935. Two complete sexual seasons of 1933 and 1934 were included in the studies of all groups with the exception of that of Group VIII.

The results of the extensive oestrous observations indicate that, under eastern Transvaal conditions, Merino sheep of various ages which have been subjected to the treatments indicated, experience restricted annual sexual activity. It may be said that the sexual season commences in February and terminates in August, although the duration of the sexual season of certain individuals extends beyond these limits (Appendix 1A, Tables IX to XVI). It is to be noted that, in the case of the veld groups which react in body weight to the altering conditions of the seasons, sexual activity increases when body weight decreases during the autumn and early winter months, and that, while body weight increases rapidly during the spring and early summer months, sexual activity is absent. In the case of the controlled fed groups in which very little or no gain of body weight is reflected, the rhythm of the sexual seasons corresponds to that of the former groups. (Table VI and Diagram 2A).

A conception of the great variation of the extent of sexual activity of individuals in all groups can be obtained by consulting Tables XVII to XXIV of Appendix 1A. While certain members of a group exhibit the ultimate degree of sexual activity expected, others experience no activity or only 1, 2, or 3 dioestrous cycles during a sexual season. By consulting the weights of indivadual sheep (Appendix 1A, Tables I to VIII), it becomes apparent that the heaviest sheep of any group are not necessarily the most active, nor are the lightest the least active.

Individual differences of sexual activity are greater in the groups of young sheep, Groups I to IV, on low level rations, and such differences become greater during the second sexual season on such rations. Attention is drawn to Sheep No. 29324 which exhibited a continuous series of regular dioestrous cycles from the beginning of April, 1934, to the middle of January, 1935 (Appendix 1A, Table IX). In the more mature sheep on a low level ration, individual differences are marked only during the second sexual season.

In the case of the sheep on veld (Group VI), individual differences are less marked than in the case of the groups on low level rations, and, while such differences are not increased during the second sexual season, the least active sheep during the first season are also least active during the second season. Greater individual variation occurs in the group of sheep on veld supplemented with maize throughout the year. Three sheep in this group experienced exceptionally short anoestrous periods during the spring of 1934 (Appendix 1A, Table XV). In this case too, the least active during the first season are least active during the second sexual season. The two least active sheep are not exceptionally heavy or exceptionally light in body weight (Appendix 1A, Table VII). In the case of Group VIII, which was permitted green grazing throughout the year, a certain amount of individual variation occurs during the first season, but such variation is considerably reduced during the second season and, in this case, the activity of the least active sheep during the first season excels that of others during the second sexual season. One sheep in this group experienced a relatively short anoestrum during the spring of 1934 (Appendix 2A, Table XVI).

Group summaries of the sexual seasons are contained in Table III of the text.

The sheep in Groups I to IV were 22 months old when they were drafted into the experiment towards the end of the sexual season of 1932. It is apparent from Table III that the greater percentage of these sheep were sexually inactive during the latter part of the 1932 sexual season. It will be shown in a subsequent experiment that only 20-40 per cent. of Merino sheep at 18 to 23 months of age experience sexual activity under eastern Transvaal conditions (Experiment 6). It is seen that 100 per cent. of the mature sheep in Group V exhibited oestrus during the latter part of the 1932 sexual season.

The mean duration of the true anoestrous period is reflected only in the case of Group V, in which all sheep were observed to have been sexually active during part of the preceding sexual season (1932). However, from the few cases in Groups I to IV that can be used for a comparison, it appears that the anoestrous period at the commencement of the experiment was longer in the younger sheep than in the mature sheep of group V, the mean duration of the anoestrous period of which was approximately 130 days. As the observations on Groups VI and VII were commenced when all

the sheep were in anoestrum, the periods of duration of the 1932-1933 anoestrous period cannot be used for comparative purposes, although they indicate the total absence of oestrus for the given lengths of time (Table III).

Significant comparisons may be made from the time of the onset of the 1933 sexual season up to the termination of the 1934 sexual season (Tables III and IV of the text).

1. The results obtained from Groups I and II reveal the following:—

(*a*) During 1933, the mean duration of the sexual season of Group I is 16·1 days longer than that of Group II; in the latter group cases of extreme short duration of the season occur. During 1934, the mean durations of the sexual seasons are almost identical, although the range of variation is greater in the case of Group I.

(*b*) The mean numbers of dioestrous cycles in Group I during the sexual seasons of 1933 and 1934, exceed those in Group II by 1·2 and 1·1 respectively.

(*c*) During the 1933 and 1934 sexual seasons, the cases in which oestrus recurs after the normal period of 16 to 19 days, is greater in Group I by 7·1 and 8·6 per cent. respectively.

(*d*) The mean anoestrous period (1933-1934) of Group I is 17·8 days shorter than that of Group II.

(*e*) Both groups show decreased sexual activity during the second season.

2. When a portion of the low level maize ration is replaced by a protein rich concentrate, cottonseed meal, as in Group III, the results as compared to Groups I and II reflect marked reductions in sexual activity:

(*a*) The mean durations of the 1933 and 1934 sexual seasons are reduced by 51·4 and 55·2 days respectively as compared to Group I and by 35·3 and 54·3 days respectively as compared to Group II.

(*b*) The mean number of dioestrous cycles during the sexual seasons of 1933 and 1934 are reduced by 3·9 and 2·6 respectively as compared to Group I and by 2·7 and 1·5 respectively as compared to Group II.

(*c*) During the 1933 and 1934 sexual seasons, the cases in which oestrus recurs after the normal period of 16-19 days are 55·2 and 50 per cent. respectively as compared to 90·1 and 79·6 per cent. in Group I and 83·0 and 71·0 per cent. in Group II.

(*d*) The mean anoestrous period (1933-1934) of Group III is of longer duration than that of Groups I and II by 56·7 and 38·9 days respectively.

(*e*) A marked decrease in sexual activity occurs during the second sexual season.

3. When the maize ration is withdrawn from a low level ration of maize, teff hay, bone meal, and salt, after a period of 224 days, as in Group IV, no immediate detrimental effects upon sexual activity result, but marked reductions in activity are evidenced during the next sexual season:

(*a*) The mean duration of the 1933 and 1934 sexual seasons are 158·5 and 43·0 days respectively, the longest duration during the latter sexual season being only 117 days.

(*b*) The mean number of dioestrous cycles is 8·9 during 1933 and only 2·9 during the 1934 sexual season.

(*c*) Considering the two sexual seasons, there is no significant difference between the percentage of cases in which oestrus recurs after the normal period of 16 to 19 days; the percentages are 83·5 and 84·6 respectively.

(*d*) The mean duration of the 1933-1934 anoestrous period is 298·8 days which is 22·2 days in excess of that of Group I and approximately of similar duration to that of Group II.

(*e*) As a result of the withdrawal of the maize portion of the low level ration, sexual activity is greatly reduced during the second sexual season.

4. The results obtained from Group V may be compared with those of Group I, as the treatments of the groups were similar. The sheep comprising Group I were 22 months old at the commencement of the experiment, while the sheep of Group V were mature.

(*a*) The mean duration of the 1933 sexual season is 81·5 days longer in the case of the mature sheep, but the duration of the second sexual season is reduced by 116 days compared to the previous season. The reduction is greater than in the case of the younger sheep.

(*b*) The reduction of the mean number of dioestrous cycles of the mature sheep is from 10·7 to 7·4 during the sexual seasons of 1933 and 1934 respectively. On a percentage basis this reduction is approximately equal to that experienced by the younger sheep in Group I.

(*c*) The number of cases in which oestrus recurs after the normal period of 16 to 19 days is 77·5 per cent., which is 12·6 per cent. less than in the younger sheep. However, during the second sexual season, the percentage is insignificantly less in the case of the mature sheep, but it is significantly reduced in the case of the younger sheep.

(*d*) The mean anoestrous period (1933-1934) of the mature sheep is only 7.2 days less than that of the younger sheep.

(*e*) A marked decrease of sexual activity of the mature sheep occurs during the second sexual season; reduced activity is due largely to the shorter duration of the sexual season.

5. The sheep comprising Group VI were maintained on natural pasture supplemented only by bone meal and salt. The results obtained from this group will be compared with those of the dry-lot groups, and comparisons with the other veld groups will be made when the results of the latter are being considered.

(*a*) The mean duration of the 1933 sexual season of Group VI is 63·6 days less than the longest sexual season of the dry-lot groups on low level rations. No explanation can be found for this difference. The mean duration of the second sexual season of Group VI is 63·5 days longer than the longest sexual season of the groups on low level rations. The mean duration of the second sexual season (1934) of Group VI is 29·2 days longer than the previous season. This difference is due to the extension of the latter part of the season (Appendix 1A, Table XIV), and, while no exact explanation can be offered for this extension of activity, it must be remarked that abnormally good rains were experienced during the winter and early spring months of 1934 (Diagram 1) and that good sheep pasture was available by the middle of August, 1934.

(*b*) The mean number of dioestrous cycles of the veld group during the 1933 sexual season is approximately equal to that of sheep on a low level ration of maize and teff hay. The mean number of dioestrous cycles of the veld group is increased during the second sexual season, while those of the groups on low level rations are decreased.

(*c*) The number of cases in Group VI in which oestrus recurs after the normal period of 16 to 19 days is 85·9 and 79·4 per cent. during the sexual seasons of 1933 and 1934 respectively. These percentages are greater than in most low level ration groups.

(*d*) The mean anoestrous period (1933-1934) of the veld group is 204·4 days, which is shorter than any of that of the low level ration groups.

(*e*) Increased sexual activity during the second sexual season is shown by the veld group; this is due largely to the longer duration of the sexual season.

6. The results obtained by constantly supplementing natural pasture with maize, as in Group VII, are best compared with those of the veld group, Group VI.

(*a*) The mean duration of the 1933 sexual season of Group VII is 25·3 days longer than that of Group VI, but the 1934 season of the former group is only 15·8 days longer than that of the latter group. The mean duration of the second season in the case of Group VII is greatly influenced by a particularly inactive individual.

(*b*) There is no significant difference between the mean number of dioestrous cycles of Groups VI and VII during both sexual seasons.

(*c*) The percentage of cases in which oestrus recurs after the normal period of 16 to 19 days is somewhat larger during both seasons in the case of Group VI.

(*d*) The mean anoestrous period (1933-1934) of Group VII is 24 days shorter than that of Group VI.

(*e*) As in Group VI, the sexual activity of Group VII increases during the second sexual season.

7. The results obtained by supplying green feed to sheep throughout the year, as in Group VIII, may be compared with those in which no supplementary feed is given, as in Group VI, and in which natural pasture is supplemented throughout the year with maize, as in Group VII.

(*a*) Oestrous observations on Group VIII were commenced on 1.5.33, or approximately three months after the onset of the sexual season. In spite of this, the mean duration of the 1933 sexual season is 91·9 days. The mean durations of the equivalent periods of the 1933 sexual season have been computed for Groups VI and VII, and they are found to be 87·2 and 86·4 days respectively. The mean duration of the 1934 sexual season of Group VIII is 230·4 days which exceeds that of Group VI by 47·2 days and that of Group VII by 31·3 days.

(*b*) During the portion of the 1933 sexual season, the mean number of dioestrous cycles experienced by Group VIII is 6·1, while the numbers experienced by GroupsVI and VII during the identical period are 5·6 and 5·2 respectively. During the 1934 sexual season, the mean number of dioestrous cycles is 13·3, which exceeds that of Groups VI and VII by 4·1 and 4·0 respectively.

(*c*) In Group VIII, the percentage of cases in which oestrus recurs after the normal period of 16 to 19 days is approximately 90 and this greatly exceeds the corresponding percentages reflected for Groups VI and VII.

(*d*) The mean anoestrous period (1933-1934) of Group VIII is 164·9 days, which is less than that of Groups VI and VII by 39·5 and 15·5 days respectively.

(*e*) The sexual activity of Group VIII is greatly increased during the second sexual season.

None of the groups subjected to the above treatments experienced a continuous series of dioestrous cycles throughout twelve months. The greatest amount of sexual activity was shown by sheep which were permitted green grazing throughout the year. The supplementary feeding of concentrates (maize) throughout the year to sheep on pasture resulted in some increase of sexual activity as compared with the results from unsupplemented pasture. The sexual activity of sheep on low level or deficient rations declines as the time of treatment advances.

It appears from the literature cited that the extreme degree of polyoestrum is a breed characteristic of the Merino. However, it has not been established what variation of the degree of polyoestrum, due to individual differences within the breed, may be expected under ideal environmental conditions.

Further, evidence available proves that the extent of ovarian activity is influenced by environic factors one of which, namely nutrition, is of great importance.

It is highly probable that sheep are far more sensitive to nutritional deficiencies than is at present realised. While ability to reflect normal body functions under imperfect nutritional conditions for periods of considerable duration, may be an exceptional individual characteristic, it must be realised that the majority of sheep are unable to experience maximum ovarian activity when they are subjected to adverse nutritional conditions, and the reflection of such treatment becomes more marked as time progresses. While in certain areas, the deficiency of the pasture may be due to the lack of one or a few mineral or protein elements, in other areas a more complex deficiency may exist. Although it is contended that farm animals seldom suffer from vitamin deficiency, this fact has not been established for all areas. Vitamins are essential nutrients for all phases of body functions; as Aschheim (1933) points out: " The function of the endocrine glands depends greatly upon the presence of certain vitamins in the diet ".

Conclusions.

1. The effects of various combinations of low level rations upon the sexual activity of Merino sheep were studied. A control group on veld and two veld groups, the grazing of which was supplemented, were used for comparative purposes.

The observations were conducted over periods of from 18 to 26 months.

The recording of weight data indicated the reaction of body weight to the treatment imposed.

2. Irrespective of treatment, Merino sheep under eastern Transvaal conditions experience restricted annual sexual activity. The sexual season commences in February and terminates in August; the anoestrous period embraces the spring and summer months. Great individual differences with respect to degree of polyoestrum are reflected in all groups subjected to the various treatments.

3. Sheep subjected to low level rations of maize, teff hay, and salt, which permit them to maintain a weight approximating that of their winter condition, do not exhibit marked decreased sexual activity during the first 7 to 12 months of treatment, but an abrupt decline in sexual activity results after 19 to 24 months and the reduced degree of activity is influenced by the quality of the ration.

(*a*) The inclusion of bone meal in the salt lick has no significant effect upon body weight and wool production.

The addition of bone meal prevents marked reduction of the duration of the sexual season, the number of dioestrous cycles, and the increase of dioestrous cycles of abnormal duration. However, the inclusion of bone meal in such rations does not ensure normal sexual activity.

(*b*) The part substitution of the maize portion of the ration with a protein rich concentrate (cotton seed meal), has no significant effect upon body weight, but a slight improvement upon wool production.

The alteration results in an earlier decline of sexual activity and a very marked reduction of sexual activity after 18 months of treatment. The sexual season is of shorter duration, the number of dioestrous cycles is less, and the number of dioestrous cycles of normal duration is reduced.

(*c*) The inclusion of bone meal in the ration at the commencement of treatment, and the withdrawal of the maize portion of the ration after a period of approximately 7 months, or one month after the onset of the first sexual season, results in a lower constant weight level and a reduction in wool yield.

The reduction in the ration greatly reduces the duration of the sexual season and the number of dioestrous cycles.

(*d*) The sexual activity of mature sheep on low level rations is not as readily affected as in the case of younger sheep, but, when reduction of activity of the former takes place, it is more marked than in the case of younger sheep.

4. Sheep maintained on natural pasture, react abruptly in body weight and sexual activity to the seasons. The drop in body weight is greatly reduced by supplementary feeding and better wool production results. Increased sexual activity is induced by supplementing the natural pastures; the degree of improvement depends upon the nature of the feed supplied. However, the rhythm of the sexual seasons is maintained irrespective of the treatment.

(*a*) Sheep maintained on natural pasture attain their highest summer weight during February and March and they drop to their lowest weight during August; the loss in weight my be 25 per cent. of the highest summer weight.

The annual wool production may vary by approximately 2 pounds.

The sexual activity varies during different sexual seasons. It may not greatly exceed that of sheep on low level rations for periods of 7 to 12 months, but marked improvement of activity of the former may occur during the next sexual season. Under these conditions of treatment, the duration of the sexual season may be 6 months. The specific factors involved have not been identified, although it may be remarked that greater sexual activity results by the extension of the latter part of the sexual season when good rains are experienced during the winter months.

(*b*) The supplementary feeding of sheep on natural pasture with 8 to 12 ounces of maize throughout the year, does not entirely eliminate the loss in weight during the winter months; losses of approximately 6 and 11 per cent. of the highest summer weight are experienced.

While improvement of wool production may be expected, high yields of good quality are not constant. Other influential factors appear to be involved; these factors have not been identified.

Such feeding tends to increase the duration of the sexual season, but it does not result in lengthy sexual seasons in all individuals. Under these conditions of treatment, the duration of the sexual season may be 6·5 months. The normal periodicity of oestrus is not ensured.

(*c*) When sheep are permitted green grazing throughout the year, the loss in weight during the winter months is reduced to 12 to 15 per cent. of the highest summer weight.

Improvement of wool production results, but high yields of good quality are not constant.

Under such treatment, sheep experience great improvement in sexual activity. The improvement is rapid and it becomes more marked as the period of treatment progresses. The duration of the sexual season is extended; it may be 7·5 months. A significantly larger number of dioestrous cycles is experienced, and, in approximately 90 per cent. of cases, oestrus may be expected to recur after the normal interval.

5. The specific factor or factors which determine the existence of restricted annual sexual activity in Merino sheep under eastern Transvaal conditions have not been revealed by these studies, but the latter suggest that restricted seasonal activity is, to some extent, influenced by nutritional circumstances.

6. While the degree of polyoestrum exhibited during sexual seasons may be influenced by individual differences, it is apparent that nutritional factors play an important rôle. Improved treatment appears to induce greater sexual activity and to shorten the duration of the anoestrous period. Marked stimulation of ovarian activity results by permitting constant green grazing; this fact suggests the importance of the essential vitamins.

7. Sheep maintained on deficient rations for long periods of time suffer from complicated nutritive deficiency which inhibits normal ovarian activity. The availability of adequate quantities of phosphorus in the form of bone meal lick, does not result in normal sexual activity.

Experiment 1B.

High Planes of Nutrition in Dry-lot compared to Supplemented Pasture.

The results obtained from the observations in Experiment 1A, indicated the need for studying the sexual activity of Merino sheep under the same climatic conditions when high planes of nutrition are allowed. Also, the exceptionally poor results reflected by sheep the ration of which contained cotton seed meal (Experiment 1A, Group III), suggested the inclusion of tests upon the more commonly used protein rich concentrates such as: cotton seed meal, peanut meal, and blood meal. It may be said that information relative to the value of these protein rich concentrates is of particular interest to stud owners in areas where leguminous roughages cannot be grown with success, and where non-nitrogenous roughages and concentrates are the farm feeds most successfully produced.

The experiment was commenced on November 5th, 1934, and the results of 12 months are available. It may be said that it is in the interests of the experiment to extend the observations over a further period of at least 12 months; these results will be published in a subsequent issue of the Onderstepoort Journal.

The following general outline indicates the plan of the experiment:—

(*a*) The feeding of maize with teff hay and a salt lick.
  (1) Group I: no nitrogenous supplement.
  (2) Group II: supplemented by cotton seed meal.
  (3) Group III: supplemented by peanut meal.
  (4) Group IV: supplemented by blood meal.

(*b*) On natural pasture: Group V: supplemented by a bone-meal and salt lick and green cereal grazing during the winter months.

Each of the above groups consisted of ten Merino ewes of good type and approximately three years of age.

The ewes were taken from the Research Station's available flock; consequently, their breeding histories were not known. They were shorn just previous to their inclusion in the experiment, hence their entire wool growth was made during experimental treatment.

As indicated in a previous section (Experiment 1A), data upon the digestible nutrients of South African feedstuffs are not available. In consequence, the nutritive requirements of the sheep could not be computed. In the case of Group I, the quantity of maize fed

was based upon the reaction to maize feeding reflected in Experiment 1A, Group VII. Although, for reasons previously stated, the digestibility of South African feed-stuffs cannot be accepted to be similar to that of American feed-stuffs, the tables of digestible nutrients given by Henry and Morrison (1923) were the most suitable guide in compiling the concentrate constituents of the rations of Groups II to IV. It was endeavoured to compound the rations so that the crude protein and total digestible nutrients of all rations were as nearly as possible equal. In the case of Group I, the ration of which contained no protein rich supplement, the crude protein content of the ration is low. The following Table I indicates the details of the rations fed to the groups. In connection with the lick consumption, it must be pointed out that the lick was supplied ad lib.

TABLE I.

The Rations.

Group.	Daily ration of concentrates, roughage and lick per sheep per day.						Digestible nutrients in concentrate portion of daily ration.			
	Maize.	Cotton-seed meal.	Pea-nut meal.	Blood meal.	Teff hay.	Salt.	Crude protein.	Carbo-hydrates.	Fat.	Total digestible nutrients.
	oz.	oz.	oz.	oz.	lb.	oz.	lb.	lb.	lb.	lb.
I.....	8	—	—	—	2·5	0·19	0·0385	0·3305	0·2300	0·4210
II.....	4	5	—	—	2·5	0·25	0·1172	0·2446	0·0357	0·4424
III.....	5	—	4	—	2·5	0·23	0·1246	0·2412	0·0373	0·4678
IV.....	6	—	—	3	2·5	0·24	0·1606	0·2512	0·0192	0·4550
V.....	6*b*	—	—	—	—	0·23	—	—	—	—

All issues of lick were made as required and they were entered on the feed-room record sheet.

Due to the severity of the winter months, Group V could not be given green cereal for two hours daily throughout the winter months, so that it was necessary to resort to supplementing the natural pasture by maize for short periods.

The particulars of the management of Group V are as follows:—

(1) 5.11.34 to 6.5.35: on natural pasture without supplements.

(2) 7.5.35 to 17.8.35: on natural pasture with cereal grazing for 2 hours daily.

(3) 18.8.35 to 4.9.35: on natural pasture with 6 oz. maize.

(4) 5.9.35 to 7.10.35: on natural pasture with cereal grazing for 2 hours daily.

(5) 8.10.35 to 31.10.35: on natural pasture with 6 oz. maize.

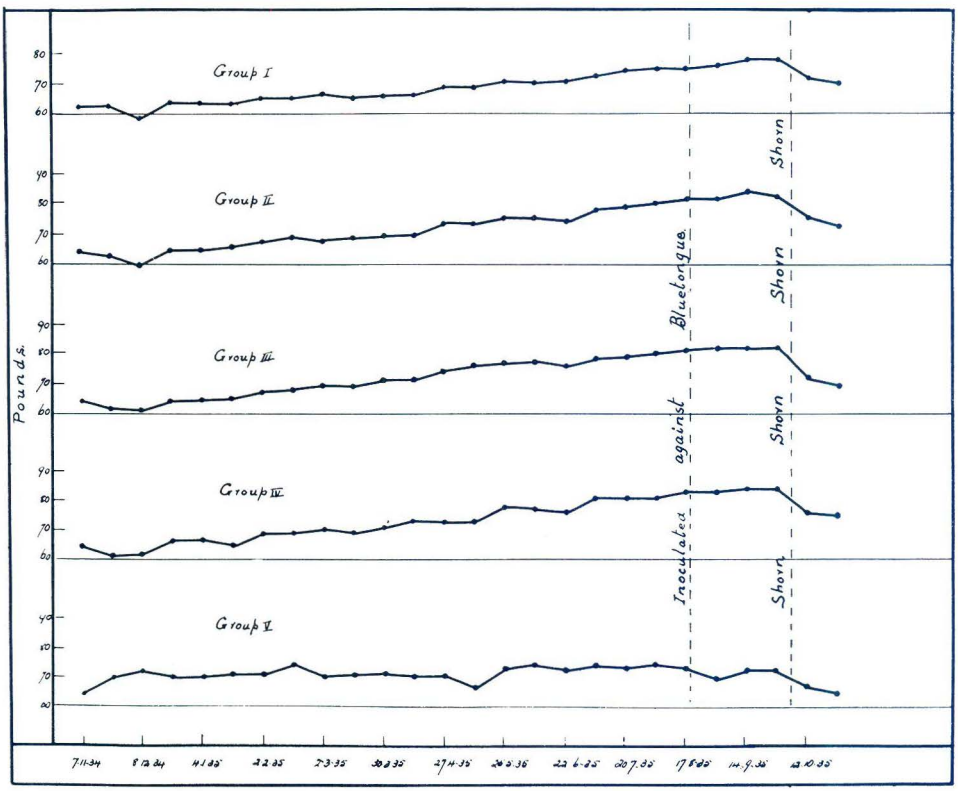
The details of general management of these groups were identical to those of the groups of Experiment 1A, and the methods employed have been given under the section of Experiment 1 dealing with such matters.

Results.

The weight data of Groups I to V, taken at 14-day intervals, are given in Appendix 1B, Tables I to V, from which Diagram 2B has been constructed.

DIAGRAM 2B.

EXPERIMENT 1B.



Mean weights of groups at 14 day intervals.

The results of the oestrous observations on the five groups of sheep are given in Appendix 1B, Tables VI to X. The results obtained from individual sheep have been analysed and the data of interest have been included in the latter tables. These data have been condensed in Table II of the text in order to permit a comparison of the groups.

TABLE II.

The Sexual Activity of Merino Sheep on High Level Rations.

Group	Period between commencement of testing and 1st oestrus.		No. of dioestrous cycles.		Duration of sexual season.	
	Range.	Average.	Range.	Average.	Range.	Average.
	days.	days.			days.	days.
I.....	27–172	65·4	2–18	11·2	17–291	186·1
II.....	28– 96	45·5	2–19	11·3	19–304	203·6
III....	30–117	59·2	3–18	12·8	106–314	229·6
IV.....	27– 99	53·1	3–17	10·2	87–295	209·5
V.....	42–157	66·1	4–17	10·7	77–290	201·8

Group.	Frequencies of the periodicity of oestrus (days).																												Total.	Period between last oestrus and the termination of testing for oestrus.	
	10	13	14	15	16	17	18	19	20	21	23	24	32	33	34	35	36	37	38	39	47	49	51	52	56	68	70	87	168		Range.	Average.
																															days.	days.
I.....	—	—	—	—	17	41	35	4	1	—	—	—	—	—	—	1	2	—	—	—	—	1	—	—	—	—	—	—	—	102	35–172	107·3
II.....	1	1	—	1	11	35	34	5	—	1	1	1	—	—	2	5	1	1	—	1	—	—	—	1	—	—	1	—	—	103	10–174	89·8
III....	—	—	2	3	22	49	21	6	1	—	—	—	2	—	6	3	1	1	—	—	—	—	—	—	—	—	1	—	—	118	17–139	73·2
IV.....	—	1	1	1	8	42	22	3	1	—	—	—	—	—	3	2	1	—	1	—	—	—	1	1	1	1	—	1	1	92	38–248	99·4
V.....	—	—	1	—	4	50	18	3	1	2	—	—	—	1	4	4	3	—	—	1	1	2	1	1	—	—	—	—	—	97	8–159	87·3

The shearing results obtained from the groups are given in Table III of the text.

TABLE III.

Wool Production.

Group.	No. of sheep.	Grease wool Yield.		Staple length.		Tensile strength No. of sound fleeces.	Spinning quality frequencies.			
		Range.	Average.	Range.	Average.		60s.	64s.	70s.	74s.
		lb.	lb.	ins.	ins.					
I....	10	5·5– 8·1	7·4	2·00–2·75	2·5	10	—	2	8	—
II...	10	6·6–12·4	9·2	2·50–3·00	2·8	10	—	2	7	1
III..	10	5·5–11·0	8·2	2·25–3·00	2·6	10	—	5	5	—
IV...	10	8·5–11·8	10·0	2·50–3·00	2·8	10	1	9	—	—
V....	10	6·3– 9·7	8·0	2·25–3·00	2·6	10	—	—	9	1

Photographs of the five groups are given in Figures 17 to 21.

Discussion.

The reactions of Groups I to IV to the altered conditions of dry-lot feeding are reflected in the reduction in weights during the first 28 days of the experiment (Diagram 2B). The sheep on pasture, Group V, show an increase in weight during that period; this may be expected of such sheep during November and December of a good sheep year (Diagram 1). During the remainder of the experimental period, Group V maintains a fairly constant mean weight; the temporary abrupt decline early in May is a reaction to the commencement of the winter conditions, but it has been seen that supplementary feeding was started on 7 May, 1935, hence the response to the treatment was immediate. Subsequent slight fluctuations in weight evidenced during the latter part of August may be expected during severe winter conditions. Although Group V attained a maximum mean weight of only 74 pounds, for practical purposes it would be considered that they maintained a satisfactory weight level for normal body function and production. The sheep did not lose weight as was evidenced in the groups on pasture in Experiment 1A (Groups VI and VIII).

The dry-lot fed groups reflect greater gains in weight. Group I, on a maize ration unsupplemented by a protein concentrate, made gradual gains in weight; the levels of 70 and 79 pounds were attained 10 weeks after the protein supplemented ration groups reached those levels, while the mean weight of the former immediately prior to shearing was from 3 to 5 pounds less than that of the latter groups. There is no great difference between the weight curves of Groups II, III, and IV. The group receiving blood meal as a supplement, Group IV, made slightly faster gains during the first six months of the experimental period, but subsequently the weight curves are almost identical, although the group receiving peanut meal as a supplement, Group III, shows a greater tendency to maintain its weight just prior to shearing, and the post-shearing weight of the latter group is 4 pounds less than that of Groups II and IV.

The wool production results (Table III) are of interest, not only from a point of view of the production efficiency of the treatments, but also as they may indicate whether treatment or rations which are satisfactory from a wool production aspect, are as efficient with respect to the functions of the body concerning reproduction.

In spite of the greater body weight gains of Group I as compared to those of Group V, the wool production of the former is below that of the latter in every respect. Obviously, significant differences exist between the wool productions of Groups II, III and IV. The production of Group III is seen to approximate that of the veld group, Group V, although the former contained more fleeces of lower spinning qualities. The wool production of Groups II and IV are considered excellent for sheep of that type; the number of high spinning quality fleeces in Group II and low spinning quality fleeces in Group IV is a point of interest.

It may be said that wool production is improved by the inclusion of cottonseed meal and blood meal in the carbonaceous rations of Merino sheep, while the results obtained by feeding a high level carbonaceous ration are not as satisfactory as those reflected by Merino sheep under good farm veld management.

The details of the results of the oestrous observations and the analyses of these data reveal interesting facts (Appendix 1B, Tables VI to X).

It is obvious that all groups were in anoestrum during November, 1934, not a single occurrence of oestrus was observed during that month.

The sexual season commenced during December and, excluding a small percentage of cases, 8 per cent., the sexual season is restricted. In this connection particular attention is drawn to the marked individual differences which occur in the duration of the sexual season in all groups; while 18 and 19 dioestrous cycles were experienced by certain individuals in the various groups, others in the same groups experienced only 2 and 3 dioestrous cycles. Mention of similar individual differences was made in discussing the results of sheep on low level rations in Experiment 1A.

Table II of the text presents a summary with respect to the sexual activity of the groups.

It is seen that the group on a concentrate ration consisting of maize only, Group I, and the veld sheep, Group V, experienced longer delay in the onset of the sexuol season than did Groups II, III, and IV.

Previous reference has been made to the range of variation which exists in all groups with regard to the number of dioestrous cycles experienced and the duration of the sexual season. Group III, receiving peanut meal as a supplement, experienced most dioestrous cycles, 12·8, and the mean duration of the sexual season is longest, 229·6 days, the latter being 26 and 20·1 days longer than those of Groups II and IV respectively. The equivalent data of the veld sheep, Group V, do not differ greatly from that of Group IV.

While Group I experienced an average of 11·2 dioestrous cycles, the duration of the sexual season was only 186·1 days, or 15·7 days less than that of the veld sheep and 43·5 days less than that of the group in which the sexual season was of longest duration. The last columns reveal that increased duration of the sexual season of Group III must be attributed to the extension of the latter part of the season. It is apparent that a similar extension in the case of Group V was responsible for the comparatively long season of this group for, as previously stated, the onset of the season was delayed. In this latter respect, the seasons of Groups I and V may be compared. The shorter season of the former group is due to the termination of the sexual season at an average period of 107·3 days before the end of the observation period. It is well to remark at this point that the winter conditions during 1935 were particularly severe, and that, during the latter part of winter, low and high temperatures were experienced while spring rains were exceptionally late. It can only be suggested that the periodic grazing on green cereals of sheep in satisfactory winter condition, results in comparatively favourable sexual activity, as reflected in the number of dioestrous cycles experienced and the extension of the sexual season. In the case of Groups II and IV, the average duration of the inactive period following the sexual season is 16·6 and 26·2 days longer than that of Group III.

The data relative to the periodicity of oestrus in Table II of the text have been analysed and presented in Table IV. It is seen that oestrus recurred with greatest regularity in Group I, the range of the duration of the dioestrous cycles is narrowest, and, in as great a number as 95·1 per cent. of cases, oestrus recurred after 16 to 19 days. The latter percentages in the cases of Groups II, III, and IV reveal insignificant differences between these three groups. The equivalent result in Group V, 77·3 per cent., is considerably below that of the other groups. Dioestrous cycles, the duration of which are multiples of that of the normal cycle, cannot be said to occur during the first or last part of the sexual season; the distribution of such abnormal cycles is very general and there appears to be no relationship between their occurence and the extent of sexual activity during the sexual season (Appendix 1B, Tables VI to X).

TABLE IV.

The Periodicity of Oestrus.

Group.	Total No. of inter-oestrous periods.	Range of periods after which oestrus recurred	Percentage of cases in which oestrus recurred after a period of 16–19 days.
		days.	Per cent.
I.....	102	16–49	95·1
II.....	103	10–70	82·5
III.....	118	14–70	83·0
IV.....	92	13–168	81·3
V.....	97	14–52	77·3

No explanation can be given for the failure of oestrus to recur with greater consistency; nor is it possible to attribute the significant differences of the irregularity between groups to a specific factor or set of factors. Grant (1934) has pointed out that, when oestrus observations are made only once daily, failure to observe oestrous periods of short duration may result. From the results of Experiment 3 of this thesis, it would appear unlikely that a large percentage of oestrous periods would not be detected by testing for oestrus at 24-hour intervals.

Previous mention has been made of the presence of sheep in all groups, the number of dioestrous cycles of which is considerably less than that of other members of the groups. By examining the data, it is found that in several cases the least active sheep are the lightest sheep in their groups. However, the relationship does not hold good for all cases. Table V of the text has been constructed from Appendix 1B, Tables I to X in order to present this aspect. As the groups were subjected to different treatments for approximately 12 months, the average initial weight of all groups is best used as a basis for classifying the light and heavy weight members of each group. It is seen that, in the cases of Groups I, II, and IV, the mean number of dioestrous cycles experienced by the lighter sheep is 4·4, 3·0, and 4·0 less respectively than that of the heavier sheep; in Groups III and V the equivalent differences are only 1·7 and 1·5 respectively. Also, it becomes obvious that the mean numbers of dioestrous cycles experienced by the lighter sheep are less than the averages for the particular groups. However, attention is drawn to the fact, as indicated by the range of variation of the number of dioestrous cycles, that in all groups individuals of light body weight experienced larger numbers of cycles than the mean value of the particular group.

TABLE V.

Relation between Body Weight and Sexual Activity.

Group.	No. of sheep above (*a*) and below (*b*) average initial weight of 63·5 lb.	No. of dioestrous cycles.		Average No. of dioestrous cycles of the groups.
		Range.	Average.	
I (*a*)	5	10–18	13·4	11·2
(*b*)	5	2–14	9·0	
II (*a*)	6	2–19	12·5	11·3
(*b*)	4	6–15	9·5	
III (*a*)	6	10–16	13·5	12·8
(*b*)	4	3–18	11·8	
IV (*a*)	6	5–17	11·8	10·2
(*b*)	4	3–13	7·8	
V (*a*)	6	7–17	11·3	10·7
(*b*)	4	4–13	9·8	

Attention is once more drawn to the fact that the licks of the sheep in this experiment consisted only of salt, bone meal being excluded. The salt consumption varied from 0·19 to 0·25 ounces per sheep per day. However, although the mineral content of the rations of the different groups varied, each content of the rations containing nitrogenous supplements was appreciable, especially in the case in which cotton seed meal was fed (Group II). The analyses of the feed-stuffs used are given in Appendix 1A, Table XXVI.

Special reference is made to the results of sexual activity obtained when cotton seed meal was fed in a low level ration (Experiment 1A, Group III). In this case, reduced sexual activity was observed within the first 12 months of treatment and, during the second sexual season, activity was reduced to a very great extent. In this experiment, 1B, Group II, no detrimental effects are evidenced during the first 12 months as a result of the inclusion of cottonseed meal in a high level ration.

Conclusions.

1. The effects upon the sexual activity of Merino ewes of three nitrogenous concentrates fed as supplements in high level rations were studied over a period of 12 months. The results of such treatments have been compared to that in which no nitrogenous supplement was included, and to that of sheep maintained on veld with good range management. The effects of all treatments upon body weight and wool production have been analysed.

2. With respect to body weight gains, cottonseed meal, peanut meal, and blood meal are suitable supplements to maize and teff hay, as such rations induce greater increase in weight than does a ration consisting of maize as the sole concentrate, or does natural pasture which is supplemented according to general range management.

3. The inclusion of cottonseed meal and blood meal in the ration improves wool production; the addition of peanut meal gives similar results, as does good range management; and the feeding of maize and teff hay without a nitrogenous supplement results in reduced wool yields.

4. Sheep subjected to high planes of nutrition, including adequate quantities of nitrogenous supplements, experience restricted annual sexual activity, although the additions of the supplements lengthen the duration of the sexual season.

(*a*) Sheep under good range management experience 10·7 dioestrous cycles during a sexual season of 201·8 days' duration.

(*b*) Sheep on a ration of maize and teff hay experience 11·2 dioestrous cycles during a sexual season of 186·1 days' duration.

(*c*) Sheep on a ration of maize and teff hay, supplemented by cottonseed meal, experience 11·3 dioestrous cycles during a sexual season of 203·6 days' duration.

(*d*) Sheep on a ration of maize and teff hay, supplemented by peanut meal, experience 12·8 dioestrous cycles during a sexual season of 229·6 days' duration.

(*e*) Sheep on a ration of maize and teff hay, supplemented by blood meal, experience 10·2 dioestrous cycles during a sexual season of 209·5 days' duration.

5. The duration of the sexual season and the number of dioestrous cycles of sheep receiving adequate quantities of nitrogenous supplements, are as variable as in the case of sheep on a highly carbonaceous ration or of sheep which are given good range management.

6. The sexual activity of sheep which are in poor condition, as reflected by body weight, is less than that of sheep which are well conditioned. This fact is largely responsible for the great individual difference with respect to degree of sexual activity.

When a limited number of dioestrous cycles is experienced by individuals, such cycles occur either at the beginning or about the middle of the sexual season.

7. The failure of oestrus to recur with regular periodicity occurs during all stages of the sexual season, and "silent" oestrous periods are experienced by the most active as well as by the least active sheep.

No explanation can be offered for the occasional absence of oestrus and for the significant differences of such absence which is apparent in groups of sheep subjected to various treatments.

EXPERIMENT 1A.

Fig. 1.—Group I: 22.9.33.

Fig. 2.—Group I: 31.8.34.

Fig. 3.—Group II: 22.9.33.

EXPERIMENT 1A.

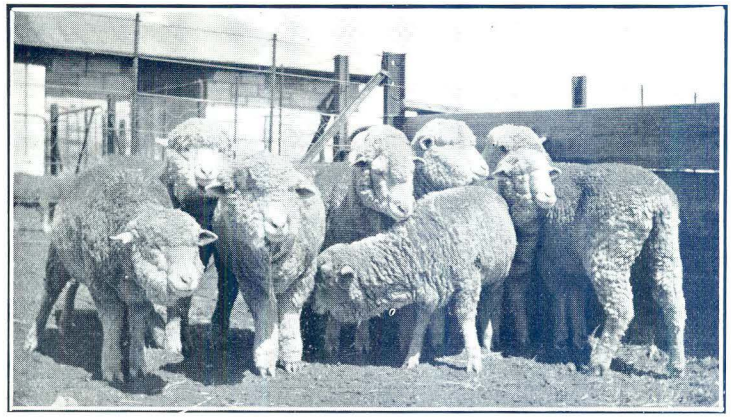


Fig. 4.—Group II: 31.8.34.

Fig. 5.—Group III: 22.9.33.

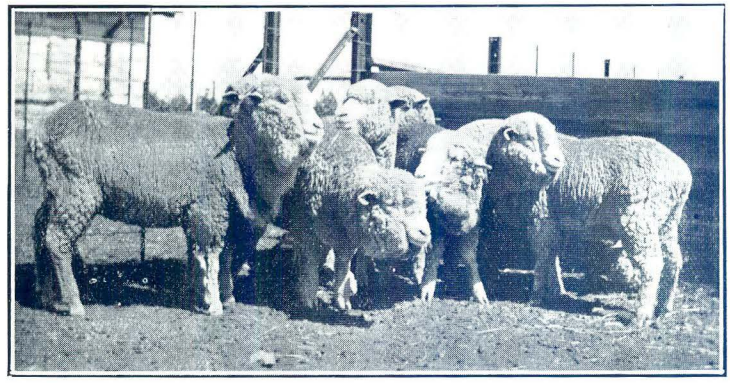


Fig. 6.—Group III: 31.8.34.

EXPERIMENT 1A.

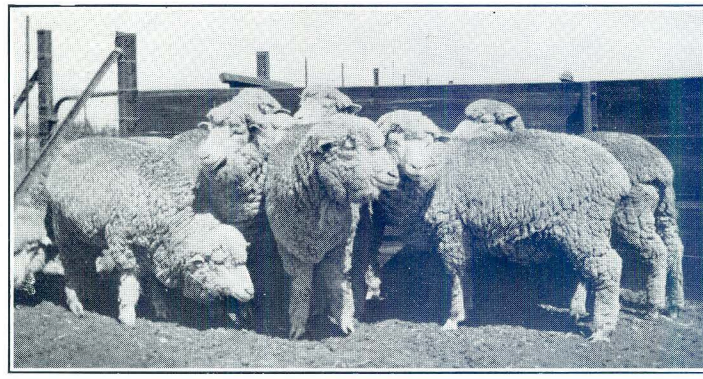


Fig. 7.—Group IV: 22.9.33.

Fig. 8.—Group IV: 31.8.34.

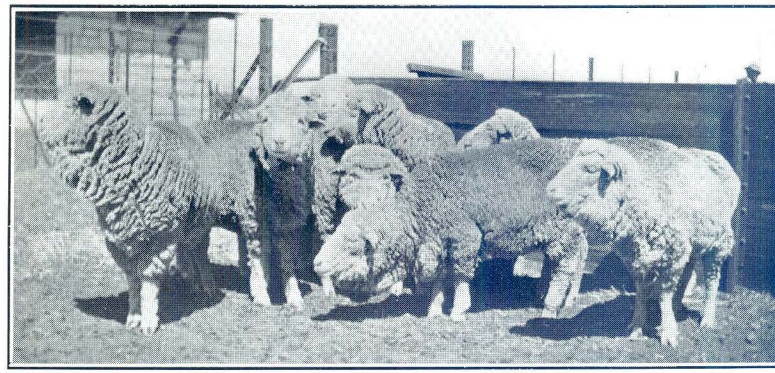


Fig. 9.—Group V: 22.9.33.

EXPERIMENT 1A.

Fig. 10.—Group V: 31.8.34.

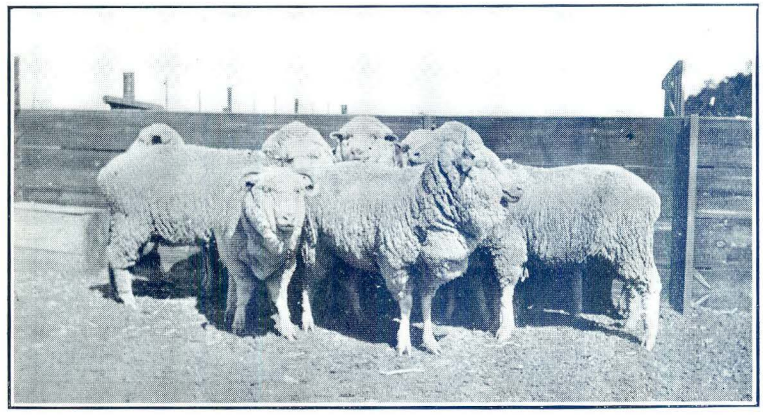


Fig. 11.—Group VI: 22.9.33.

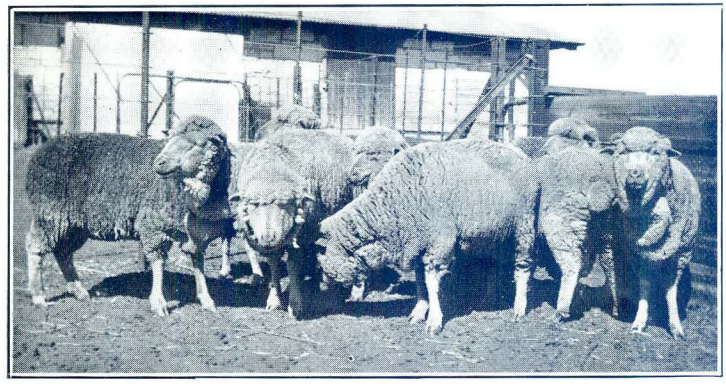


Fig. 12.—Group VI: 31.8.34.

EXPERIMENT 1A.

Fig. 13.—Group VII: 22.9.33.

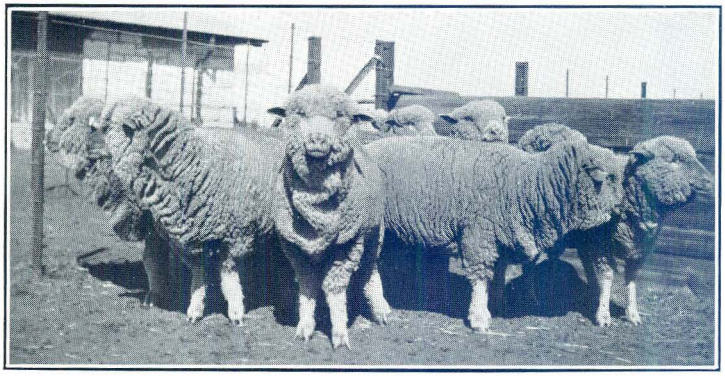


Fig. 14.—Group VII: 31.8.34.

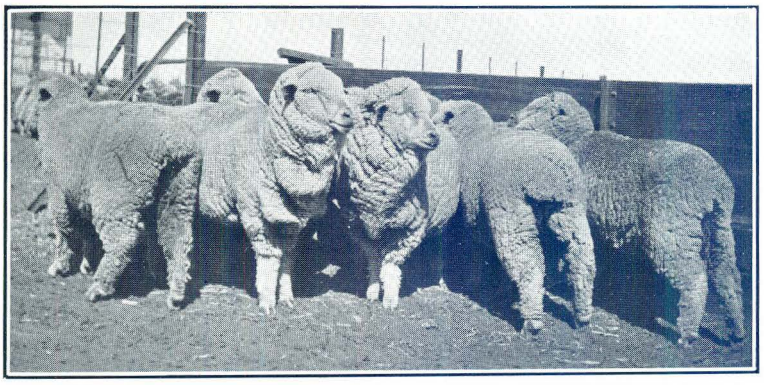


Fig. 15.—Group VIII: 22.9.33.

EXPERIMENT 1A.

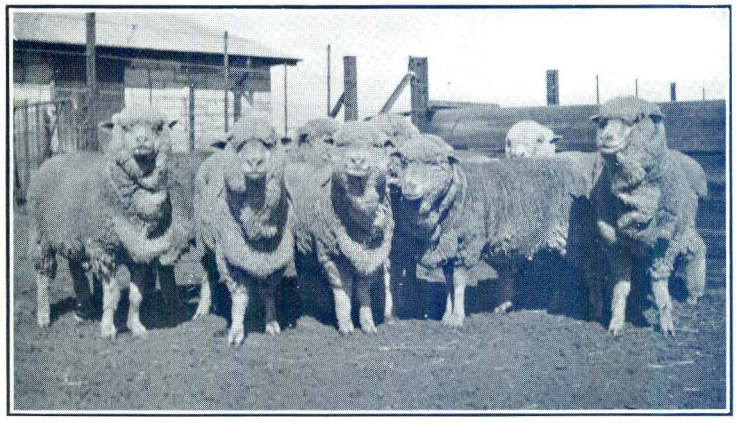


Fig. 16.—Group VIII: 31.8.34.

EXPERIMENT 1B.

Fig. 17.—Group I: 23.7.35.

Fig. 18.—Group II: 23.7.35.

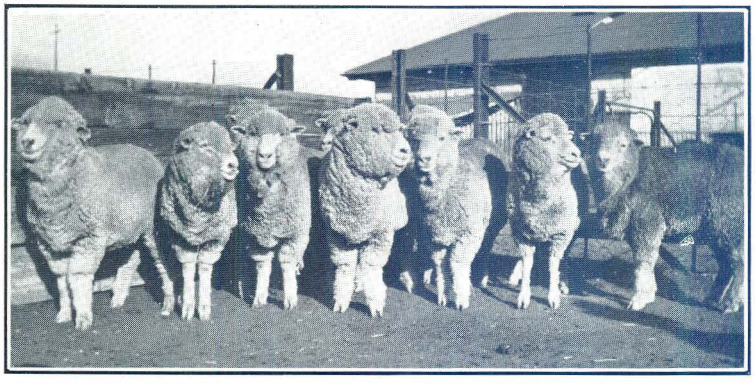


Fig. 19.—Group III: 23.7.35.

EXPERIMENT 1B.

Fig. 20.—Group IV : 23.7.35.

Fig. 21.—Group V : 23.7.35.

EXPERIMENT 2.

The Morphology of the Ovaries of Merino Sheep during Anoestrum.

The object was to study the morphology of the ovaries of Merino sheep during anoestrum.

Materials and Methods.—Sixty-nine Merino flock sheep were slaughtered for macroscopical examination of the ovaries.

The sheep utilized constituted a number of groups which had been under observation in experiments relevant to the present study. Details of the treatments to which the various groups were subjected and their reactions, especially the history of their sexual activity, may be found by consulting Experiment 1A of this thesis. However, brief extracts have been made for incorporation with the data of this experiment in order to facilitate the necessary association between the experiments. In Groups I to VIII of this experiment, the same order of individuals and groups has been maintained as that occurring in Experiment 1A.

All sheep slaughtered had not shown oestrus for a period equivalent to at least two dioestrous cycles of normal duration; the majority of sheep were slaughtered 3 to 4 months after their last exhibition of oestrus; in some exceptional cases no sexual season had occurred and oestrus had not been observed for over a year. Due to existing circumstances, not more than four sheep could be slaughtered weekly, so that a more definite system of slaughtering individuals from each of the groups at specific intervals during anoestrum was not possible. When selecting sheep for slaughter on a particular date, it was attempted to obtain cases the inactive periods of which were, as nearly as possible, multiples of a normal dioestrous cycle.

The sheep were starved for 12 to 14 hours, at the end of which period they were weighed and slaughtered. Immediately after slaughtering, the uteri and ovaries were removed by dissecting along the margins of these organs. The ovaries were placed in small specimen dishes on moist blotting paper on which details for identification had been noted. The uteri were placed in large specimen dishes on moist blotting paper on which the numbers of the ewes were recorded. The specimen dishes were covered until the weighing and measuring of the organs were undertaken and this was completed within an hour after slaughtering.

The procedure of examining the uteri and ovaries was as follows: The uteri were weighed and they were then placed in specimen bottles containing Jore's solution, and on which particulars of identification were noted. The ovaries were weighed and returned to the specimen dishes. The macroscopical examination of individual ovaries was undertaken. Measurements were made as follows: (1) length from pole to pole, (2) depth from the attached to the free border, and

(3) width from the median to the lateral face. Three readings were taken of each dimension and the average of the three readings was recorded. The surface of the ovary was carefully examined and described with respect to the number and size of Graafiian follicles present, the presence or absence and size of corpora lutea, and remnants of previous corpora lutea. The ovary was sectioned along its length from pole to pole, care being taken to observe the presence and the nature of fluid liberated. When follicles and corpora lutea were sectioned, detailed descriptions of these were made. The sectioned ovary was held up to the light in order to obtain a second count of the Graafian follicles and to ascertain whether any small corpora lutea had remained hidden below the surface of the ovary. In cases in which the section through the length of the ovary was not sufficient to expose objects of interest, further sections were made. Directly after the examination of an ovary was completed, it was placed in a specimen jar containing Jore's solution and on which particulars of identification were noted.

The uteri and ovaries were forwarded to the Director of Veterinary Services, Onderstepoort, Pretoria. The histological examinations of these specimens will be reported upon as a separate study.

Results.

As previously indicated, the sheep used in this experiment were obtained from other experiments reported upon in this thesis; hence Groups I to VIII correspond in identical order to Groups I to VIII of Experiment 1A. In order to facilitate reference to the treatment of the groups, Table I of the text is presented in conjunction with the results of this experiment.

TABLE I.

The Treatment of the Groups.

Group.	Oestrous observations commenced.	Treatment (rations per sheep per day).	No. of sheep slaughtered.
I.....	24. 7.32	Dry-lot: Maize, 4 oz.; teff hay, 2·5 lb.; bonemeal and salt ad lib.....	9
II.....	24. 7.32	,, Maize, 4 oz.; teff hay, 2·5 lb.; salt ad lib.....	10
III.....	24. 7.32	,, Maize, 2·7 oz.; cotton seed meal, 1·3 oz; teff hay, 2·5 lb.; salt ad lib...	9
IV (*a*)	24. 7.32	,, Maize, 4 oz; teff hay, 2·5 lb.; bonemeal and salt ad lib.....	—
(*b*)	2. 3.33	,, Teff hay, 3 lb.; bonemeal and salt ad lib	9
V.....	24. 7.32	,, Maize, 4 oz.; teff hay, 3·0 lb.; bonemeal and salt ad lib.....	7
VI.....	7.10.32	Pasture: Bonemeal and salt ad lib.....	9
VII.....	7.10.32	,, Maize, 8–12 oz.; bonemeal and salt ad lib	7
VIII....	1. 5.33	,, Bonemeal and salt, green grazing during winter.....	9

NOTE.—Although the above Groups I to VIII each contained 10 sheep at the commencement of the observations, in certain instances individuals died during the period of the experiments, and in other instances oestrus occurred after relatively short anoestrus periods.

The detailed results of this experiment are given in Appendix 2. Complete details of the results of the macroscopical examinations of the ovaries are outlined, while, in each case, brief sexual histories, extracted from Experiment 1A, have been appended (Experiment 1A, Appendix 1, Tables IX to XXIV).

The data recorded in Appendix 2 have been compiled in Tables II to X of the text in order to reflect the results of the examinations of the ovaries more clearly. It must be understood that the counts of the number of Graafian follicles present were obtained without the use of magnification.

Discussion.

The British breeds of sheep experience an anoestrous period in their home country and abroad during the spring and summer months (Heape, 1901; Marshall, 1903, 1922; Marshall and Hammond, 1926; Roberts, 1921; Cole and Miller, 1933; Grant, 1934). Although Quinlan and Maré (1931) found that Merino sheep under South African Karroo conditions experience a continuous series of dioestrous cycles throughout the year, Küpfer (1928) observed that, in the western Free State, South Africa, Merino and Woolled Persion sheep enter a sexually inactive period during the late winter months.

The oestrous observations carried out on the sheep slaughtered for this experiment, indicate that the sheep had experienced definite periods of seasonal sexual activity and inactivity. The sexual seasons of the sheep have been discussed in the report of Experiment 1A. It has been indicated in a previous section of the report of this experiment that all sheep were in anoestrum at the time of slaughter.

No previous records upon the weights of the uteri of sheep are available.

The weights and measurements of the ovaries of Merino sheep during the ovarian cycle are given by Quinlan and Maré (1931), who found that " . . . the ovaries are lightest just subsequent to ovulation and heaviest when the corpus luteum (1) reaches its maximum development, that is, from the sixth day of the interoestrous period ". These investigators found that the lightest ovaries weighed 0·67 and 0·63 gms.; the heaviest weighed 2·25 gms. on the 10th day of the interoestrous period; and an ovary containing a corpus luteum measuring $1·2 \times 1·0$ cm. on the 13th day of the interoestrous period, weighed 1·98 gms. Further, it is indicated that the size of the ovary is greatly affected by the size of the corpus luteum and to a smaller extent by the size of Graafian follicles. It is stated with regard to the latter, that rapid follicular development occurs during the first few days after ovulation, when follicles measuring 0·75 to 0·86 cm. may be found. Grant's (1934) observations on Scottish sheep led to the conclusion that follicular development during the earlier part of the interoestrous period is less rapid. It appears from the data of the former authors that mature follicles in the ovaries of Merino sheep measure about 0·8 to 1·0 cm.

TABLE II.

Group I.—Macroscopic Examination of the Ovaries.

Sheep No.	Age.	Condition.	Weight	Last oestrus observed	Period between last oestrus observed and slaughter.	Uterus weight.	Ovaries.				*Graafian Follicles.*			*Corpora Lutea.*	
							Left.		Right.		No. observed.		Largest.		
							Weight.	Size.	Weight	Size.	Left. ovary.	Right. ovary.		I.	II.
	years.		lb.	date.	days.	gm.	gm.	cm.	gm.	cm.			cm.	cm.	cm.
29252	4	good	74·0	2.8.34	91	22·5	0·82	1·3×1·3×0·9	0·63	1·2×1·1×0·8	9	6	0·6	0	0
29270	4	fair	61·0	22.7.33	339	—	0·70	1·2×1·0×0·8	0·56	1·1×1·0×0·7	6	8	0·5	0	0
29324	—	—	—	—	not slaughtered	—	—	—	—	—	—	—	—	—	—
29325	4	fair	62·5	7.8.34	150	20·5	0·62	1·5×1·2×0·7	0·63	1·2×1·1×0·9	11	3	0·3	0	0
29328	4	poor	58·5	13.5.34	111	26·5	0·58	1·1×1·1×0·7	0·66	1·1×1·1×0·8	3	5	0·5	0	0
29340	4	good	80·5	22.4.34	138	22·5	0·56	1·3×1·0×0·8	0·72	1·3×1·1×0·8	15	15	0·3	0	0
29805	4	good	65·0	10.8.34	142	30·5	0·55	1·2×1·1×0·8	0·65	1·3×1·1×0·8	11	8	0·6	0	0
29815	4	poor	48·0	19.6.34	98	15·5	0·51	1·2×1·0×0·8	0·38	1·2×0·8×0·6	8	7	0·3	0	0
32476	3½	fair	60·0	26.6.34	88	21·5	0·54	1·4×1·0×0·7	0·40	1·3×0·8×0·6	11	3	0·3	0	0
32491	3½	fair	64·5	3.8.34	154	21·0	0·50	1·4×0·9×0·7	0·46	1·3×0·95×0·75	4	3	0·5	0	0

TABLE III.

Group II.

35508	4	good	67·0	1.8.34	92	25·5	0·78	1·4×1·3×0·8	0·66	1·4×1·1×0·6	12	12	0·5	0·5×0·5	0
35509	4	good	74·0	9.7.34	95	18·5	0·68	1·2×1·2×0·8	0·51	1·2×1·0×0·7	5	4	0·3	0	0
29274	4	good	67·0	10.7.34	94	24·0	0·49	1·2×1·0×0·7	0·63	1·4×1·0×0·8	7	1	0·6	0	0
29279	4	fair	63·0	14.5.33	458	—	0·39	0·9×0·8×0·6	0·42	1·0×0·9×0·6	6	5	0·4	0	0
29335	4	poor	44·0	31.7.34	143	15·5	0·59	1·4×1·0×0·8	0·74	1·3×1·2×0·85	7	6	0·4	0	0
29341	4	fair	67·0	17.7.34	164	40·0	0·71	1·4×1·3×0·8	0·66	1·3×1·1×0·8	9	15	0·2	0·5×0·4	0
29793	4	fair	56·5	26.7.34	155	36·5	1·40	1·5×1·2×1·6	0·58	1·3×1·05×0·7	7	10	0·5	1·2×1·0	0
29827	4	good	73·0	12.8.34	138	24·0	0·64	1·2×1·2×0·7	0·63	1·1×1·1×0·8	10	14	0·4	0·4×0·4	0
32480	4	fair	61·0	28.7.34	146	27·5	0·62	1·1×0·9×0·75	0·48	1·2×0·9×0·7	11	8	0·5	0·2×0·2	0
32493	3½	good	74·0	15.8.34	128	21·0	0·54	1·0×1·2×0·7	0·46	1·2×1·0×0·65	2	5	0·5	0	0

TABLE IV.

Group III.—Macroscopic Examination of the Ovaries.

Sheep No.	Age	Condition.	Weight	Last oestrus observed	Period between last oestrus observed and slaughter.	Uterus weight.	Ovaries.				*Graafian Follicles.*			*Corpora Lutea.*	
							Left.		Right.		No. observed.		Largest.		
							Weight.	Size.	Weight	Size.	Left. ovary.	Right. ovary.		I.	II.
	years.		lb.	date.	days.	gm.	gm.	cm.	gm.	cm.			cm.	cm.	cm.
35499	4	fair	68·5	11.5.34	119	20·5	0·89	1·6×1·1×0·9	0·88	1·5×1·1×0·7	6	4	0·2	0	0
35498	4	fair	57·0	14.7.33	405	18·5	0·61	1·2×1·1×0·7	0·42	1·0×0·9×0·6	10	6	0·3	0·2×0·2	0
29258	4	good	89·0	19.7.34	105	23·5	0·72	1·4×1·2×0·7	0·80	1·4×1·2×1·0	7	7	0·5	0	0
29265	4	fair	63·0	28.6.34	106	27·5	0·67	1·2×1·1×0·7	0·57	1·2×0·9×0·8	4	6	0·5	0	0
29273	4	poor	65·0	27.5.34	110	22·5	0·68	1·3×1·1×0·9	0·55	1·2×1·1×0·8	6	6	0·6	0	0
29283	4	good	73·0	30.3.34	151	19·5	0·45	1·2×1·1×0·7	0·52	1·2×1·1×0·8	5	6	0·4	0·2×0·4	0
29330	died 22.11.32	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29334	4	fair	58·0	19.6.34	95	18·5	0·52	1·2×1·0×0·8	0·38	1·1×0·9×0·8	7	7	0·3	0	0
32482	3½	fair	65·0	9.7.34	115	18·5	0·63	1·5×1·0×0·7	0·48	1·4×0·9×0·6	10	4	0·3	0	0
32495	3½	good	88·0	31.8.34	57	20·5	0·48	1·4×1·0×0·6	0·58	1·4×1·1×0·7	3	2	0·5	0	0

TABLE V.

Group IV.

29261	4	poor	52·0	7.2.34	204	19·5	0·56	1·2×1·1×0·7	0·53	1·3×0·9×0·7	8	5	0·3	0	0
29268	4	fair	64·0	30.7.34	66	21·5	0·67	1·5×1·1×0·8	0·50	1·3×1·1×0·7	10	7	0·3	0	0
29298	4	fair	69·0	26.6.34	100	23·5	0·44	1·3×1·0×0·7	0·72	1·5×1·1×0·8	8	10	0·2	0	0
29306	4	fair	64·5	1.7.34	95	19·5	0·60	1·3×1·2×0·8	0·75	1·5×1·1×0·8	6	9	0·2	0	0
29309	4	fair	62·5	20.6.34	99	15·5	0·62	1·5×1·0×0·8	0·88	1·6×1·2×0·9	10	19	0·2	0	0
29316	4	fair	69·0	16.6.34	98	24·0	0·58	1·4×1·0×0·7	0·60	1·5×1·1×0·7	6	6	0·4	0	0
29822	4	poor	50·0	20.7.33	406	16·0	0·53	1·2×0·9×0·7	0·53	1·1×1·0×0·7	9	7	0·3	0	0
29825	4	fair	59·5	19.5.34	118	18·5	0·46	1·2×1·0×0·7	0·64	1·3×1·1×0·7	4	10	0·2	0	0
29830	died 16.1.34	—	—	—	—	—	—	—	—	—	—	—	—	—	—
35500	4	fair	66·0	11.9.33	353	17·5	0·45	1·1×0·9×0·6	0·61	1·2×1·0×0·7	6	7	0·5	0	0

Table VI.

Group V.—Macroscopic Examination of the Ovaries.

Sheep No.	Age.	Condition.	Weight	Last oestrus observed	Period between last oestrus observed and slaughter.	Uterus weight.	Ovaries.				*Graafian Follicles.*			*Corpora Lutea.*	
							Left.		Right.		No. observed.		Largest.		
							Weight.	Size.	Weight	Size.	Left. ovary.	Right. ovary.		I.	II.
	years.		lb.	date.	days.	gm.	gm.	cm.	gm.	cm.			cm.	cm.	cm.
35507	aged	fair	51·0	6.9.33	351	32·0	0·64	1·4×1·1×0·6	0·53	—	4	4	0·3	0	0
35506	6	fair	61·0	27.8.34	109	40·0	1·13	1·8×1·4×0·8	1·22	1·8×1·5×0·9	12	12	0·4	0	0
35505	died	—	—	—	—	—	—	—	—	—	—	—	—	—	—
13367	13.12.33 died	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15323	27.12.33 6–7	good	74·0	8.7.33	413	50·5	0·66	1·5×1·0×0·6	0·80	1·4×1·2×0·8	2	5	0·5	L: O. 2×0·3 R: O. 2×0·2	0
21658	6	good	81·0	16.10.34	52	34·5	0·90	1·6×1·2×0·7	0·93	1·6×1·2×0·9	12	7	0·5	0	0
25876	6	fair	58·0	11.7.34	156	27·0	0·65	1·5×1·1×0·75	0·85	1·5×1·3×0·8	14	15	0·2	0	0
25882	died	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25883	24.2.33 6	poor	53·0	13.6.34	101	32·5	0·58	1·3×1·1×0·7	0·60	1·3×1·1×0·8	12	6	0·3	0	0
25907	7	poor	53·0	3.10.34	52	34·5	0·51	1·1×1·2×0·6	0·42	0·9×1·1×0·6	3	4	0·5	0	0

Table VII.

Group VI.

15257	6	fair	75·0	10.8.34	91	48·0	1·66	2·2×1·4×0·9	0·69	1·5×1·2×0·8	7	8	0·4	1·1×1·2	0
15327	7	fair	63·5	5.8.34	159	60·5	1·93	1·8×1·9×1·1	1·03	1·5×1·5×0·7	6	15	0·4	1·1×1·2	0
21504	7	poor	57·0	23.8.34	141	35·5	0·75	1·5×1·1×0·8	0·48	1·1×1·1×0·7	10	11	0·5	0·6×0·6	0
21607	died	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24928	30.9.33 7	fair	72·0	25.9.34	68	45·0	1·35	1·9×1·4×0·9	1·20	1·8×1·4×0·8	5	11	0·3	0	0
25873	6	good	80·0	27.7.34	168	41·5	0·79	1·5×1·3×0·8	1·15	1·6×1·5×0·9	7	15	0·3	0·3×0·3	0
35501	7	v. gd.	84·0	4.9.34	101	37·5	0·81	1·5×1·5×0·9	0·48	1·4×0·9×0·6	5	3	0·55	0·6×0·5	0
35496	7	v. gd.	87·0	3.9.34	88	20·5	0·56	1·3×1·0×0·7	0·61	1·4×1·0×0·7	4	6	0·5	0	0
35502	6	poor	68·0	27.6.34	198	33·5	0·93	1·4×1·3×1·0	0·72	1·3×1·1×0·8	24	7	0·5	0	0
35497	7	good	95·0	3.9.34	88	29·5	0·65	1·5×1·1×0·7	0·68	1·2×1·2×0·9	8	4	0·6	0	0

TABLE VIII.

Group VII.—Macroscopic Examination of the Ovaries.

Sheep No.	Age.	Condition.	Weight	Last oestrus observed	Period between last oestrus observed and slaughter.	Uterus weight.	Ovaries.				*Graafian Follicles.*			*Corpora Lutea.*	
							Left.		Right.		No. observed.		Largest.		
							Weight.	Size.	Weight	Size.	Left. ovary.	Right. ovary.		I.	II.
	years.		lb.	date.	days.	gm.	gm.	cm.	gm.	cm.			cm.	cm.	cm.
15351	7	good	84·0	29.10.34	33	52·5	0·72	1·3×1·2×0·9	0·60	1·4×1·0×0·7	6	2	0·8 (mature)	0	0
15521	—	—	—	—	not slaughtered	—	—	—	—	—	—	—	—	—	—
22210	6	good	75·0	11.9.34	66	31·5	1·20	1·4×1·5×0·9	1·10	1·5×1·2×0·7	20	15	0·3	0	0
22547	—	—	—	—	not slaughtered	—	—	—	—	—	—	—	—	—	—
24355	—	—	—	—	not slaughtered	—	—	—	—	—	—	—	—	—	—
25105	6	v. gd.	95·0	19.9.34	79	30·5	0·82	1·5×1·2×0·8	1·79	1·9×1·4×1·2	17	19	0·5	1·5×1·55	0
25308	7	good	83·5	2.9.34	103	47·5	1·37	1·4×1·8×1·25	0·86	1·45×1·2×0·9	4	6	0·4	1·2×0·8	0·15×0·15
25338	7	good	72·0	15.5.34	121	77·5	1·52	1·7×1·6×1·1	1·22	1·6×1·6×0·9	5	6	0·5	0·2×0·2	0
35503	6	v. gd.	99·0	24.8.34	90	47·5	0·60	1·3×1·0×0·8	2·63	1·9×1·4×1·7	4	2	0·7	1·0×1·2	0·3×0·5
35504	6	v. gd.	98·0	15.9.34	55	49·5	1·14	1·6×1·2×0·9	0·91	1·4×1·3×0·9	15	6	0·6	0·8×0·5	0

TABLE IX.

Group VIII.

21500	6	v. gd.	84·0	2.10.34	38	45·5	0·87	1·6×1·1×0·8	1·53	1·4×1·2×1·4	12	9	0·8	1·2×1·0	0
22050	6	v. gd.	87·0	4.9.34	101	39·5	0·72	1·2×1·0×0·8	1·13	1·4×1·5×1·0	11	4	0·4	1·2×0·9	0
25025	6	v. gd.	97·0	11.7.34	164	47·5	1·35	1·7×1·5×1·0	1·16	1·7×1·6×0·9	14	10	0·6	0·7×0·6	0
25948	—	—	—	—	not slaughtered	—	—	—	—	—	—	—	—	—	—
35708	7	v. gd.	83·0	5.8.34	78	40·0	0·97	1·6×1·2×0·8	1·05	1·5×1·2×0·9	9	15	0·5	0	0
35732	6	good	74·0	24.7.34	115	30·5	0·60	1·4×1·0×0·8	0·71	1·3×1·2×0·8	7	8	0·3	0	0
35994	6	v. gd.	100·0	18.9.34	80	37·0	0·84	1·4×1·3×0·8	0·89	1·5×1·2×0·9	12	9	0·6	0	0
37058	7	good	83·0	9.9.34	117	56·5	0·75	1·5×1·05×0·8	0·74	1·5×1·1×0·8	5	4	0·4	0·5×0·3	0
37059	6	v. gd.	89·0	30.9.34	40	51·5	0·99	1·5×1·4×1·0	0·61	1·4×1·0×0·8	4	6	0·7	0·5×0·5	0
37061	6	v. gd.	102·0	18.9.34	108	47·0	1·41	1·65×1·3×1·1	0·63	1·2×1·15×0·7	10	9	0·4	1·0×0·9	0

In discussing the results of the examination of the ovaries of the sheep in this experiment, it appears best to consider each of the groups separately at first, as the various groups were subjected to different treatments while under observation in Experiment 1A.

Group I.—The group was maintained on a low level ration of maize, teff hay, bonemeal and salt (Table I).

The results of the macroscopic examinations of the ovaries are given in Table II of the text; the weights of the uteri have been included.

No marked relationship exists between body weight or condition and the weight of the uterus, although the uterus of the lightest and a poor conditioned sheep, No. 29851, weighed only 15·5 gms. On the other hand, it must be pointed out that the uterus of another sheep in poor condition, sheep No. 29328, weighed 26·5 gms.; however the live weight of this sheep exceeded that of the former sheep by 10·5 lb. It is of interest to note that the periods between the last oestrus observed and the date of slaughter of these sheep were 111 and 98 days respectively.

The majority of the ovaries weigh less than the lightest ovaries observed by Quinlan and Maré (1931) in Merino sheep; the sizes of the former are also somewhat less than those of the latter. Although some of the smallest and lightest ovaries contain only a small number of Graafian follicles, other light ovaries contain even more follicles than the heaviest and the largest. Most follicles are small and, although follicles measuring 0·5 and 0·6 cm. are present, none were considered to be approaching maturity. The poor conditioned sheep had light ovaries, but the two ovaries of each sheep contain between 8 and 15 follicles; in one case the largest follicle measured 0·5 cm.

The fact that no corpus luteum was present in any of the ovaries indicates that ovulation had not occurred recently.

Group II.—The group was maintained on a low level ration of maize, teff hay, and salt (Table I).

The results of the macroscopic examinations of the ovaries are given in Table III of the text; the weights of the uteri have been included.

Considerable variation exists between the weights of the uteri of the sheep in fair and good condition, the range being from 18·5 to 40·0 gms.; however, the sheep in poorest condition (44 lbs.) had a uterus weighing only 15·5 gms.

Fifty per cent. of the ovaries may be considered light in weight and of small dimensions, the remainder more nearly approach those at particular stages described by Quinlan and Maré (1931). It is obvious from the table, that the larger and heavier ovaries are those containing corpora lutea; also, it is apparent that the latter ovaries have more numerous follicles, although they do not all contain comparatively large follicles.

The presence of the corpora lutea indicate that ovulation had occurred recently, although it must be pointed out that in no case is there a second corpus luteum present, indicating that the last ovulation was not preceded by an ovulation. In such instances, ovulation must have occurred without the exhibition of oestrus, as, in such cases, the periods between the last oestrus observed and the date of slaughter ranged between 92 and 164 days.

Group III.—The group was maintained on a low level ration of maize, cotton seed meal, teff hay, and salt (Table I).

The results of the macroscopic examinations of the ovaries are given in Table IV of the text; the weights of the uteri have been included.

The weights of the uteri range between 18·5 and 27·5 gms. and the weight of the uterus of the poorest conditioned sheep exceeds that of the average of the group.

The weights and the dimensions of the ovaries vary considerably; only the largest equal the lightest of those at particular stages described by Quinlan and Maré (1931). One of the heaviest and best conditioned sheep, No. 32495, is seen to have light ovaries containing relatively few Graafian follicles.

In two cases, small corpora lutea are present, so that ovulation had occurred in each case; however, no evidence of a preceding ovulation exists. The ovulations occurred without the exhibition of oestrus and it is to be noted that in one case, Sheep No. 35498, oestrus had not been observed for 405 days.

Group IV.—The group was maintained on a low level ration of teff hay, and salt (Table I).

The results of the macroscopic examinations of the ovaries are given in Table V of the text; the weights of the uteri have been included.

The weights of the uteri do not vary a great deal, the range being 15·5 to 24·0 gms.

In the majority of cases, the ovaries are small and light in weight. While the follicles are small, appreciable numbers are present in most ovaries.

No corpora lutea are present, indicating the absence of recent ovulations. The periods between the last oestrus observed and the date of slaughter, range between 66 and 406 days.

Group V.—The group was maintained on a low level ration of maize, teff hay, bonemeal, and salt (Table I).

The results of the macroscopic examinations of the ovaries are given in Table VI of the text; the weights of the uteri have been included.

There is no relationship between live weight or condition and the weights of the uteri.

The weights and dimensions of the ovaries vary considerably and so do the numbers of follicles present in the ovaries. In three out of seven cases totals of only 7 and 8 follicles are present.

In one case only is a corpus luteum present in each of the ovaries; these corpora are very similar and they no doubt originated at a double ovulation. It is to be noted that oestrus had not been observed in this sheep, No. 15329, for 413 days.

Group VI.—The group was maintained on natural pasture throughout the year supplemented only by a mineral lick (Table I).

The results of the macroscopical examinations of the ovaries are given in Table VII of the text; the weights of the uteri have been included.

Considerable variation exists between the weights of the uteri, which range between 20·5 and 60·5 gms. Two of the best conditioned sheep have the lightest uteri and oestrus was observed in these sheep only 88 days previous to the date of slaughter.

The variations in the weights and measurements of the ovaries of individuals is appreciable; only in certain instances can this be accounted for by the presence of corpora lutea. The number of follicles in both ovaries ranges from 8 to 31. Follicles of 5 and 6 cm. are present in many of the ovaries, but, in other instances, the largest follicles are smaller in size.

Corpora lutea of varying sizes are present in five out of the nine cases examined, but in no case is a second corpus luteum (c.l.II) present. The corpora lutea are considered to be corpora at various stages during interoestrous periods.

Group VII.—The group was maintained on natural pasture supplemented throughout the year by maize and a mineral lick (Table I).

The results of the macroscopic examinations are given in Table VIII of the text; the weights of the uteri have been included.

All the sheep were in good and very good condition. The weights of the uteri range from 30·5 to 77·5 gms.; the sheep possessing the heaviest uterus had not shown oestrus for 121 days.

The weights and measurements of the ovaries are seen to be affected by the presence of corpora lutea which are present in five out of the seven cases examined. It is seen that the lightest and smallest ovaries are those of Sheep No. 15351 which had ceased sexual activity only 33 days previous to the date of slaughter. The ovaries of this sheep contain only a total of eight discernible follicles, the largest of which is 0·3 cm. In the case of Sheep No. 15921, slaughtered 66 days after the termination of the sexual season, the ovaries are appreciably heavier and larger; they contain a total of 35 follicles, but the largest is only 0·3 cm. The majority of the cases in which corpora lutea are seen to have been present, contain relatively few follicles.

The corpora lutea are considered to have been in different stages of the interoestrous period and it must be noted that in two cases corpora lutea (II) of the previous interovulation periods are found to be present.

Group VIII.—The group was maintained on natural pasture supplemented by green cereal grazing during the winter months and by a mineral lick throughout the year (Table I).

The results of the macroscopic examinations of the ovaries are given in Table IX; the weight of the uteri have been included.

All the sheep are seen to have been in good and very good condition. The weights of the uteri range from 30·5 to 56·5 gms. There appears to be no important relationship between the condition and weights of the sheep and the weights of the uteri, neither between the weights of the uteri and the lengths of the periods of sexual inactivity.

The variations in the weights of the ovaries are due to the presence or absence of corpora lutea, although the ovaries of the cases in which corpora are not present are not small and light, and they contain appreciable numbers of follicles the largest of which are 0·5 and 0·6 cm. in diameter. The total numbers of follicles in the ovaries containing corpora lutea vary from 9 to 24.

Corpora lutea are present in six out of the nine cases examined; the corpora appear to be in various stages of the interoestrous period. In no case is a corpus luteum of the previous interovulation period present.

A summary of the macroscopic examinations of the ovaries of Groups I to VIII is given in Table X of the text. This table permits a comparison of the groups and it should reflect any significant differences due to the treatments to which the sheep were subjected for extended periods (Table I).

It is seen that the sheep in Groups I to IV were of the same age and that they were somewhat younger than those in the remaining groups. The latter fact may, to some extent, influence the value of the following interpretations, but it must be remarked that sheep of four years old are fully grown and mature.

The weight reaction of the groups to the treatment has been fully discussed in the report of Experiment 1A. However, a few brief remarks here would be of interest. It is seen that the inclusion of bonemeal in the ration of Group I, did not give the favourable reflection that might have been expected, as the condition and weight of the sheep in Group II are somewhat better. The addition of a protein-rich concentrate to the ration and the exclusion of bonemeal, as in Group III, increased the mean weight above that of Groups I and II, although only one-third of the sheep acquired good condition. The exclusion of maize from a ration similar to that of Group I, cannot be said to have had a very marked effect upon the mean weight of Group IV, although the majority of the sheep have been described to have been in only fair condition.

TABLE X.

A Summary of the Macroscopic Examinations of the Ovaries.

Group.	No. of sheep.	Average age.	Frequencies of condition.				Average weight.	Class frequencies of period of days between last exhibition of oestrus and date slaughtered.					Average weight of uterus.	Ovaries.				Graafian follicles.		Corpora Lutea.	
														Left.		Right.		Average No. observed in both ovaries.	Largest range.	I No.	II No.
			Poor.	Fair.	Good.	Very good.		34–68.	69–103.	104–138.	139–173.	174 and over		Average weight.	Average size.	Average weight.	Average size.				
		Yrs.					lb.						gm.	gm.	cm.	gm.	cm.		cm.		
I....	9	3·9	2	4	3	0	62·7	0	3	2	3	1	22·6	0·60	1·3×1·1×0·8	0·56	1·2×1·0×0·8	15·1	0·3–0·6	0	0
II...	10	4·0	1	4	5	0	64·6	0	3	2	4	1	25·8	0·68	1·2×1·1×0·8	0·58	1·2×1·0×0·7	15·6	0·2–0·6	5	0
III..	9	3·9	1	5	3	0	69·6	1	1	5	1	1	21·1	0·63	1·3×1·1×0·7	0·58	1·3×1·0×0·8	11·7	0·2–0·6	2	0
IV...	9	4·0	2	7	0	0	61·8	1	4	1	0	3	19·5	0·55	1·3×1·0×0·7	0·64	1·4×1·1×0·7	16·3	0·2–0·5	0	0
V....	7	6·6	2	3	2	0	61·6	2	1	1	1	2	35·8	0·72	1·4×1·2×0·7	0·76	1·2×1·0×0·7	16·0	0·2–0·5	2	0
VI...	9	6·6	2	3	2	2	75·7	1	4	0	3	1	33·0	0·94	1·6×1·3×0·9	0·78	1·4×1·2×0·8	17·3	0·3–0·6	5	0
VII..	7	6·4	0	0	4	3	86·6	3	3	1	0	0	48·1	1·05	1·5×1·4×1·0	1·30	1·6×1·3×1·0	18·1	0·3–0·8	5	2
VIII.	9	6·2	0	0	2	7	88·8	2	3	3	1	0	43·9	0·94	1·5×1·2×0·9	0·94	1·4×1·2×0·9	17·5	0·4–0·8	6	0

The older sheep in Group V received similar treatment to Group I. It has been indicated in the report of Experiment 1A that the former group maintained a more constant weight than the latter group, which showed a gradual increase almost equivalent to the weight of the growth of wool.

Groups VI, VII, and VIII were maintained on natural pasture. The supplementary feeding of maize in the case of Group VII is reflected to appreciable advantage with respect to condition and weight. However, the condition and mean weight of Group VIII show improvement over that of Group VII; the former group was permitted green grazing throughout the year.

The class frequencies of the period between the termination of the sexual season and the date of slaughter are given in Table X. Each class extends for a period of 34 days or two normal dioestrous cycles. The difficulty of slaughtering large numbers of sheep at one time has been indicated. In cases in which no sexual activity occurred during the last sexual season, or in which the sexual season was abnormally short, the period between the last oestrus observed and the time of slaughter is comparatively long.

The average weights of the uteri have been computed and they are given in the table. The uteri of the younger sheep in Groups I to IV are considerably lighter than those of the older sheep in the remaining groups, but, as the former groups may be considered to have been mature at four years of age, the difference has, no doubt, resulted from the treatment on low level rations for a period of 744 days (Experiment 1A, Table V). It is interesting to note that the mean weight of the uteri of Group II exceeds that of Group I by 3·2 gms.; that of Group I exceeds that of Group III by 1·5 gms. and that of Group IV by 3·1 gms. Sheep in Group IV, which had been on a low level ration consisting only of teff hay, bonemeal, and salt for a period of 520 days, had the lightest uteri ranging from 15·5 to 24·0 gms. and averaging 19·5 gms. In this connection, it is of interest to recall the results reflected in Experiment 1A relative to the number of dioestrous cycles and the duration of the last sexual season of the groups. The section of the table (Experiment 1A, Table VI) is repeated here to permit an easier comparison, and it is referred to as Table XI in this report. It appears from the table that, while little difference in sexual activity exists between Groups I and II, significant differences occur in the cases of Groups III and IV, and especially in the latter group.

The uteri of the older sheep in Group V are 13·2 gms. heavier than those of Group I which received similar treatment, but the sheep in the former group were older when the treatment was commenced. It appears, therefore, that low level rations inhibit the development of the uteri of young sheep.

The weights of the uteri of Group V may be compared with those of Groups VI, VII, and VIII, which were maintained on natural pasture with various supplements. In the case in which only bonemeal and salt were fed as supplements, Group VI, and the sheep were allowed to respond to summer and winter conditions of

pasture, the difference in the mean weights of the uteri is 4·8 gms. the uteri of the veld group being heavier than those of the low level ration Group V. When a veld pastured Group VII was fed a supplementary ration of maize throughout the year in addition to the mineral lick, the mean weight of the uteri is 48·1 gms. which is 9·1 gms. in excess of the control group, and 4·2 gms. in excess of the mean weight of the uteri of sheep which had received green grazing and a constant supply of mineral lick throughout the year.

It appears from the above results that nutrition affects the weight of the uteri of sheep.

TABLE XI.

Sexual Season, 1934.

Group.	(*a*) No. of sheep.	No. of sheep exhibiting oestrus.	Mean No. of dioestrous cycles.	Duration of season.	
				Range.	Mean.
				days.	days.
I.....	10	9	5·8	21–286	111·8
II.....	10	9	4·7	35–174	117·2
III.....	9	8	3·2	1–142	62·9
IV.....	9	7	2·9	1–117	43·0
V.....	7	5	7·4	62–185	101·6
VI.....	9	9	9·2	102–244	183·2
VII.....	10	10	9·3	1–291	199·1
VIII.....	10	10	13·3	154–280	230·4

NOTE.—(*a*) All the sheep in certain of the groups were not slaughtered for Experiment 2.

Due to the influence of the presence of corpora lutea upon the weights of the ovaries (Quinlan and Maré, 1931), it is not possible to compare the mean weights of the ovaries of the groups. However, corpora do not occur in two groups, Groups I and IV; the totals of the two mean weights of the ovaries of these groups are 1·16 and 1·19 gms. respectively.

As the dimensions of the ovaries are affected by the presence of follicles and corpora lutea (Quinlan and Maré, 1931), a comparison of measurements would be of no value.

Excepting in the case of Group III, the average number of Graafian follicles present in the ovaries does not vary greatly. Previous attention was drawn to the comparative inactivity of Group III during the last sexual season (Table XI); the average number of follicles distinguished in two ovaries is 11·7. On the other hand, Group IV was less active during the last sexual season and the average number of follicles observed in the ovaries is 16·3. The ovaries of the most sexually active groups contain an average of 17·5 and 18·1 follicles.

The size of the largest follicles varies from 0·2 – 0·5 cm. and 0·4 to 0·8 cm. Only one follicle at the point of rupture was seen (Appendix 2, Group VII, Sheep No. 15351). It will be seen by examining the details in Tables II to IX, that in many cases the ovaries of sheep which had not shown oestrus for long periods contained follicles measuring 0·5 and 0·6 cm. Grant (1934) states that " It is not yet known whether follicles are constantly growing and regressing during anoestrum or whether follicular development is simply arrested ". No evidence has become available from these examinations as to what actually takes place. It may be thought improbable that the development of follicles, which are half the size of mature follicles, would be arrested and that they could possibly remain unchanged for such long periods of time, awaiting the renewal of the increased activity of the ovaries. It may be considered more likely that follicular development during anoestrum is very slow and that regression takes place when the follicles have reached about half the size of mature follicles.

Grant's (1934) observations with Scottish sheep reveal that ovulation may occur without the exhibition of oestrus at the beginning and during the latter part of anoestrum; the author refers to these as spurious ovulations. It would appear from the results reported here on Merino sheep that such ovulations are of constant occurrence. By consulting Tables II to IX, it will be seen that corpora lutea of varying sizes are found in the ovaries of sheep which had not shown oestrus for periods varying from 38 to 413 days, many of which occur within the limits of the normal anoestrous period.

No corpora lutea are present in the ovaries of the sheep in Group I, but spurious ovulations had occurred in five cases in Group II, and the previous remarks upon the results reflected in Table X were somewhat in favour of the latter group. Although the sexual history of Group III during the last sexual season reveals poor activity of the sheep (Table XI), corpora lutea were found in the ovaries of two sheep (Table X). In Group IV, which exhibited least sexual activity during the last sexual season (Table XI), no corpora were present. In Group V a corpus luteum was found in each of the ovaries of one sheep, No. 15329 (Table VI), and oestrus had not been observed in this sheep for 413 days.

In contrast to the above low level ration groups, the pasture groups appear to have experienced a larger number of spurious ovulations during anoestrum. In the control group, spurious ovulations occurred in five out of nine cases, in Group VII in five out of seven cases, and in Group VIII in six out of nine cases (Tables VII, VIII, and IX).

It appears from the above, that the more active groups during the sexual season, experienced more spurious ovulations during the anoestrous period.

An interesting feature of the presence of corpora lutea in the ovaries of the sheep during anoestrum or during prolonged periods of inactivity, is that, in the great majority of cases, only one corpus is present. In Group V, Sheep No. 15329, two corpora of approximately equal size are present, one in each of the ovaries; these are

considered to be the corpora lutea of a double ovulation (Table VI). In Group VII, in each of two cases two corpora were found present; there is no doubt that in each case these are corpora lutea I and II. In the cases in which only one corpus is present, the body varies from the size and appearance of a recently formed corpus luteum to that of a minute corpus of a previous interovulation period (Quinlan and Maré, 1931). In such instances, in fifteen out of twenty-two cases the corpora are less than half the size of a fully developed corpus luteum. The circumstances suggest that, during anoestrum and abnormally long inactive periods, ovulation occurs without the exhibition of oestrus, but the periods at which such ovulations take place are not necessarily at the beginning or towards the end of the anoestrous period. It is apparent that, in the great majority of cases, successive spurious ovulations do not occur.

Conclusions.

1. The ovaries of 69 Merino sheep were examined during the anoestrous period; the weights of the uteri were recorded. The sheep had been subjected, for prolonged periods, to treatments involving low level rations in dry-lot and supplementary feeding on pasture.

2. During the anoestrous period, the ovaries of sheep subjected to all treatments are not static; this is true also of the ovaries of sheep maintained only on teff hay, bonemeal and salt for 520 days.

3. In certain cases, the ovaries are quiescent only to the extent that normal or complete ovarian activity is restricted. Gradual development of the Graafian follicles takes place until the follicles are approximately half the normal mature size, when development is arrested; at this stage either regression takes place, or the follicles remain in the partially developed stage for long periods. This condition occurs in sheep on low level rations, in sheep on unsupplemented pasture, in sheep maintained in good condition on pasture supplemented with the continuous feeding of concentrates (maize), and in sheep on supplementary green feed (cereals) during the dry autumn and winter months.

4. Cases exist in which ovulation occurs during the anoestrous period, or during prolonged periods of the absence of oestrus. Such spurious ovulations do not occur only at the beginning or at the end of the anoestrous period. Spurious ovulations occur in cases in which oestrus has not been observed for over a year.

(*a*) The number of cases in which ovulation occurs during anoestrum is not entirely dependent upon the level of feeding. Spurious ovulations occur even when Merinos have been maintained at a low level weight for extended periods.

(*b*) The inclusion of bonemeal in the mineral (salt) lick of sheep on a low level ration of maize and teff hay, results only in partial development of the follicles but no spurious ovulations. The exclusion of bonemeal from the ration results in the occurrence of spurious ovulations in 50 per cent. of cases.

(*c*) The exclusion of bonemeal and the inclusion of a protein rich concentrate (cotton seed meal) in a similar low level ration to the above (*b*), results in the partial development of the follicles, while spurious ovulations occur in approximately 22 per cent. of cases.

(*d*) The feeding of sheep on roughage (teff hay) and a bonemeal and salt lick, results in a more restricted partial development of the Graafian follicles and spurious ovulations do not occur.

(*e*) In sheep maintained under natural or untreated conditions, thus being allowed to react in body weight to the extremes of summer and winter grazing, the development of the follicles is not restricted at an early stage, and approximately 55 per cent. of cases experience spurious ovulation.

(*f*) In sheep maintained in good condition on pasture throughout the year by continuously supplementing with concentrates (maize), spurious ovulations occur in approximately 86 per cent. of cases.

(*g*) In sheep provided with green grazing throughout the year, spurious ovulations occur in approximately 66 per cent. of cases.

5. Successive spurious ovulations seldom occur during the anoestrous period, although such activity takes place in sheep which are maintained in good condition throughout the year as under the above Section 4 (*f*). In general, little development of the Graafian follicles is found in instances in which the corpora lutea are in advanced stages of regression.

6. In cases in which follicular development is greatly restricted during the anoestrous period, the ovaries are small and light; pairs of ovaries weigh 0·51 and 0·38 gms. When greater follicular development takes place and when spurious ovulations occur, the ovaries are larger and heavier and they approach the normal evidenced during the sexual season. When spurious ovulation occurs, the size and weight of the ovary is influenced largely by the stage of the corpus luteum present.

7. A consideration of the sexual histories of the sheep indicates that those which are more active during the sexual season are more likely to experience spurious ovulations during anoestrum.

8. Low level rations fed over extended periods, inhibit the development of the uteri of young sheep.

(*a*) The inclusion of bonemeal in such rations, reflects no advantage.

(*b*) The exclusion of bonemeal and the inclusion of a protein rich concentrate (cotton seed meal) in such rations, result in a reduced weight of the uterus.

(*c*) The feeding of a carbonaceous roughage (teff hay) and no concentrates, but a lick of bonemeal and salt, results in a further reduction of weight of the uterus.

9. The supplementary feeding of sheep on pasture results in appreciable increases in the weight of the uterus.

10. There is no obvious relationship between the length of the period of sexual inactivity and the weight of the uterus, that is, the weight of the uterus does not decrease as the inactive period progresses.

EXPERIMENT 3.

The Duration of the Phases of the Dioestrous Cycle in Merino Sheep.

The object of the experiment was to determine the duration of oestrus, dioestrum, and the dioestrous cycle in Merino sheep.

Materials and Methods.—Thirty-nine ewes of good Merino type were used in this experiment; their ages ranged from 3 to 7 years. Most of the sheep had been bred at the Experiment Station, others had been on the Experiment Station for at least a year; the sheep may, therefore, be considered to have been acclimatized.

The 39 sheep reported upon were obtained from a flock of 350 ewes by testing the latter flock for oestrus with vasectomised teasers at 7 a.m. and 5 p.m. on April 10th, 11th, and 12th, 1935. This oestrus is referred to as the preliminary or first oestrus (Table I). The ewes showing oestrus on the three dates mentioned, were drafted into a separate flock, which was run in a paddock near the observation yards. During the interoestrous period, the experimental flock was brought to the observation yards once daily and tested for oestrus until April 23rd.

On April 23rd, one ewe (No. 32657) was found to be in oestrus at 7 a.m. and from this time and date testing for oestrus was carried out at 3-hour intervals day and night, the flock being divided at the time of testing into groups of ten. Ten vigorous teasers, working in relays of five, were used to make the observations. The intensive observations were carried out until 6 a.m. on 2nd May, 1935, when all but one ewe (No. 32500) had shown and completed oestrus; oestrous observations on this ewe were continued at 12-hour intervals until she showed oestrus on 4th May, 1935.

Provision had been made to accommodate the experimental ewes in a large yard during the intensive period of testing for oestrus. The yard was supplied with the required facilities for feeding and watering. The sheep were fed on a ration of 8 ounces of crushed maize, teff hay ad lib, and a lick of 3 parts of bonemeal and 1 part of salt was supplied. The small pens of the observation yards permitted easy handling; at no time did the handling appear to fatigue the sheep. At night, observations were carried out with the aid of lanterns and electric torches. The observations were supervised at all times by a European stock foreman or by the author; a native assistant was in constant attendance.

When testing for oestrus, a ewe was not considered to be in oestrus unless she definitely stood for service. It will be seen later that the onset of oestrus was found to be abrupt, but that the passing

off of oestrus was gradual or indefinite. During the latter stage of oestrus, great care in testing had to be observed. In order to improve the thoroughness of the observations, the ewes in oestrus were kept separate, which permitted testing these ewes individually at each 3-hourly testing. In the case of ewes about to pass out of oestrus, a reluctance to stand for the teaser was found, but coaxing by the teaser induced the ewes to stand and to be served; in these cases oestrus was considered to be present. In recording the presence of oestrus the sign " O " was used. In other cases, ewes passing out of oestrus were found to circle about the teaser; they did not run away, but would not stand to be mounted. It was observed that teasers used a considerable amount of coaxing with such ewes before attempting to mount. In such cases, when the teaser had attempted to mount the ewe four times without success, the ewe was considered to be passing out of oestrus and, in recording such observations, the sign " O➢ " was used. It was observed that ewes that had definitely passed out of oestrus did not stand for coaxing by the teaser, but they jumped forward and ran away. Further, it was observed that ewes definitely showed preference for particular teasers and this was especially the case when the former were passing out of oestrus. In order to overcome any irregularity due to this peculiarity, a very vigorous teaser, which was observed to be favoured by ewes, was kept for finally testing the " non-oestrus " ewes, any doubtful cases, and particularly those ewes which were passing out of oestrus. When no oestrus was present, the sign " — " was used to record the observation. Ewes passing out of oestrus were tested individually for four periods, that is, for 12 hours, after oestrus was last observed.

During the interoestrous period of the second dioestrous cycle, that is of the so-called second oestrus, the experimental ewes were kept near the observation yards, and oestrous observations were made twice daily at 7 a.m. and 5 p.m. The procedure appeared to be necessary to ensure that no ewe with a short dioestrum and a short subsequent oestrus was missed. Such testing was continued up to 7 a.m. on May 11th.

On May 11th, one ewe (No. 32657) was found to be in oestrus at 7 a.m., and from this time and date oestrous observations were made at 3-hourly intervals day and night, the flock being similarly divided and the particular procedures being identical to those employed during the observations of the previous intensive testing for the duration of oestrus. Such observations were continued until 12 noon on May 20. One ewe, No. 32500, had not shown oestrus up to that date; the testing for oestrus of this ewe was continued beyond that date at 12-hour intervals until oestrus was observed on 28th May, 1935.

The intensive testing at each 3-hour interval took from ½ hour to 1½ hours depending upon the number of sheep and especially the number requiring individual testing.

Results.

Details of the observations are presented in Table I.

TABLE 1.

The Duration of Oestrus, Dioestrum, and the Dioestrous

Sheep No.	Age (years).	Preliminary or 1st oestrus. (Dates.)	2nd Exhibition of oestrus. Dates.	Times at which oestrus was observed. a.m. 3.	a.m. 6.	a.m. 9.	a.m. 12.	p.m. 3.	p.m. 6.	p.m. 9.	p.m. 12.	Duration of 2nd oestrus. (Hours.)	Dates.
1.	2.	3.	4.	5.								9.	10.
15337....	7	12.4.35	29.4.35– 1.5.35	—	—	—	○	○	○	○	○	30	16.5.35–17.5.35
15399....	7	10.4.35	27.4.35–28.4.35	○	○	○	○	○	○	○	○	33	14.5.35–15.5.35
18449....	5	12.4.35	30.4.35– 1.5.35	—	○	○	○	○	○	○	○	36	12.5.35–14.5.35
19444....	5	11.4.35	28.4.35–29.4.35	—	—	—	—	○	○	○	○	33	16.5.35–17.5.35
19464....	5	11.4.35	26.4.35–27.4.35	—	—	—	—	○	○	○	○	33	12.5.35–13.5.35
22027....	5	10.4.35	26.4.35–28.4.35	—	—	—	—	○	○	○	○	36	13.5.35–14.5.35
22031....	5	10.4.35	26.4.35–27.4.35	—	—	—	—	○	○	○	○	27	14.5.35–15.5.35
22035....	5	11.4.35	28.4.35–29.4.35	—	○	○	○	○	○	○	○	24	15.5.35
25930....	5	10.4.35	27.4.35–28.4.35	○	○	○	○	○	○	○	○	24	13.5.35–15.5.35
25957....	5	10.4.35	26.4.35–27.4.35	—	○	○	○	○	○	○	○	24 (+ 4½ hrs.)	12.5.35–14.5.35
25961....	5	12.4.35	29.4.35– 1.5.35	—	—	—	—	—	—	—	○	30 (+ 4½ hrs.)	17.5.35–18.5.35
26302....	5	11.4.35	28.4.35–30.4.35	—	—	—	—	—	—	—	○	48	16.5.35–18.5.35
32500....	4	11.4.35	(4.5.35)*	—	—	—	—	—	—	—	—	—	(28.5.35)*
32546....	4	10.4.35	26.4.35–28.4.35	—	○	○	○	○	○	○	○	57 (+ 1½ hrs.)	13.5.35–14.5.35
32554....	5	11.4.35	26.4.35–28.4.35	—	—	—	—	—	○	○	○	33	13.5.35–14.5.35
32657....	4	10.4.35	(23.4.35)*	—	—	—	—	—	—	—	—	—	(11.5.35)*
32934....	5	10.4.35	25.4.35–26.4.35	—	—	—	—	—	○	○	○	24	12.5.35–13.5.35
32935....	4	12.4.35	27.4.35–28.4.35	—	—	—	○	○	○	○	○	27	14.5.35–15.5.35
33149....	4	12.4.35	29.4.35–30.4.35	—	—	—	○	○	○	○	○	27 (+ 1½ hrs.)	15.5.35–17.5.35
35966....	5	10.4.35	27.4.35–28.4.35	—	—	○	○	○	○	○	○	30	15.5.35–16.5.35
35968....	5	10.4.35	27.4.35–29.4.35	—	—	—	—	—	○	○	○	33	14.5.35–15.5.35
36000....	5	12.4.35	28.4.35–29.4.35	—	—	○	○	○	○	○	○	30	14.5.35–15.5.35
36143....	3	11.4.35	27.4.35–28.4.35	—	○	○	○	○	○	○	○	21	13.5.35–14.5.35
36221....	4	10.4.35	26.4.35–27.4.35	○	○	○	○	○	○	○	○	21 (+ 4½ hrs.)	12.5.35–13.5.35
37064....	5	10.4.35	27.4.35–28.4.35	—	—	○	○	○	○	○	○	18	14.5.35–15.5.35
38083....	5	11.4.35	28.4.35–30.4.35	—	—	—	○	○	○	○	○	42	15.5.35–16.5.35
38464....	5	11.4.35	29.4.35–30.4.35	—	—	—	○	○	○	○	○	24	17.5.35–18.5.35
38516....	5	10.4.35	27.4.35	♂	♂	♂	○	♂	♂	♂	○	1	13.5.35–14.5.35
38528....	3	10.4.35	26.4.35–27.4.35	—	—	—	—	♂	○	○	○	18 (+ 1½ hrs.)	13.5.35–14.5.35
28545....	5	11.4.35	27.4.35–28.4.35	—	—	—	—	○	○	○	○	27	14.5.35–15.5.35
38546....	5	11.4.35	28.4.35–29.4.35	○	○	○	○	○	○	○	○	30	14.5.35–15.5.35
38557....	5	12.4.35	30.4.35– 1.5.35	—	○	○	○	○	○	○	○	36	17.5.35–19.5.35
38558....	5	10.4.35	26.4.35–27.4.35	—	—	—	—	○	○	○	○	30	13.5.35–14.5.35
38560....	5	11.4.35	28.4.35	○	○	○	○	○	○	○	♂	18	15.5.35
39844....	3	10.4.35	25.4.35–26.4.35	—	—	○	○	○	○	○	○	30	12.5.35–14.5.35
39872....	3	10.4.35	28.4.35–29.4.35	—	○	○	○	○	○	○	○	39	15.5.35–17.5.35
40791....	3	12.4.35	28.4.35–29.4.35	—	—	—	—	○	○	○	○	33	15.5.35–16.5.35
43454....	5	12.4.35	28.4.35–29.4.35	—	—	—	—	○	○	○	○	33	15.5.35–16.5.35
43455....	5	10.4.35	26.4.35–27.4.35	—	—	—	—	○	○	○	○	24	14.5.35–15.5.35

Sheep No.	Times at which oestrus was observed. a.m. 3.	a.m. 6.	a.m. 9.	a.m. 12.	p.m. 3.	p.m. 6.	p.m. 9.	p.m. 12.	Duration of 2nd oestrus. (Hours.)	Dates.
1.	6.								9.	10.
15337....	○	○	○	○	—	—	—	—	30	16.5.35–17.5.35
15399....	○	○	○	○	♂	—	—	—	33	14.5.35–15.5.35
18449....	○	○	○	○	○	○	—	—	36	12.5.35–14.5.35
19444....	○	○	○	○	○	○	○	—	33	16.5.35–17.5.35
19464....	○	○	○	○	○	○	○	—	33	12.5.35–13.5.35
22027....	○	○	○	○	○	○	○	—	36	13.5.35–14.5.35
22031....	○	○	○	○	○	○	—	—	27	14.5.35–15.5.35
22035....	○	○	○	○	—	—	—	—	24	15.5.35
25930....	○	○	○	○	—	—	—	—	24	13.5.35–15.5.35
25957....	○	○	○	○	—	—	—	♂	24 (+ 4½ hrs.)	12.5.35–14.5.35
25961....	○	○	○	○	—	—	—	—	30 (+ 4½ hrs.)	17.5.35–18.5.35
26302....	○	○	○	○	—	—	—	—	48	16.5.35–18.5.35
32500....	○	○	○	○	—	—	—	—	—	(28.5.35)*
32546....	○	○	○	○	—	—	—	—	57 (+ 1½ hrs.)	13.5.35–14.5.35
32554....	○	○	○	○	—	—	—	—	33	13.5.35–14.5.35
32657....	○	○	○	○	—	—	—	—	—	(11.5.35)*
32934....	○	○	○	○	—	—	—	—	24	12.5.35–13.5.35
32935....	○	○	○	○	—	—	—	—	27	14.5.35–15.5.35
33149....	○	○	○	○	—	—	—	—	27 (+ 1½ hrs.)	15.5.35–17.5.35
35966....	○	○	○	○	—	—	—	—	30	15.5.35–16.5.35
35968....	○	○	○	○	—	—	—	—	33	14.5.35–15.5.35
36000....	○	○	○	○	—	—	—	—	30	14.5.35–15.5.35
36143....	○	○	○	○	—	—	—	—	21	13.5.35–14.5.35
36221....	○	○	○	○	—	—	—	—	21 (+ 4½ hrs.)	12.5.35–13.5.35
37064....	○	○	○	○	—	—	—	—	18	14.5.35–15.5.35
38083....	○	○	○	○	—	—	—	—	42	15.5.35–16.5.35
38464....	○	○	○	○	—	—	—	—	24	17.5.35–18.5.35
38516....	○	○	○	○	—	—	—	—	1	13.5.35–14.5.35
38528....	○	○	○	○	—	—	—	—	18 (+ 1½ hrs.)	13.5.35–14.5.35
28545....	○	○	○	○	—	—	—	—	27	14.5.35–15.5.35
38546....	○	○	○	○	—	—	—	—	30	14.5.35–15.5.35
38557....	○	○	○	○	—	—	—	—	36	17.5.35–19.5.35
38558....	○	○	○	○	—	—	—	—	30	13.5.35–14.5.35
38560....	○	○	○	○	—	—	—	—	18	15.5.35
39844....	○	○	○	○	—	—	—	—	30	12.5.35–14.5.35
39872....	○	○	○	○	—	—	—	—	39	15.5.35–17.5.35
40791....	○	○	○	○	—	—	—	—	33	15.5.35–16.5.35
43454....	○	○	○	○	—	—	—	—	33	15.5.35–16.5.35
43455....	○	○	○	○	—	—	—	—	24	14.5.35–15.5.35

Sheep No.	Times at which oestrus was observed. a.m. 3.	a.m. 6.	a.m. 9.	a.m. 12.	p.m. 3.	p.m. 6.	p.m. 9.	p.m. 12.	Duration of 2nd oestrus. (Hours.)	Dates.
1.	7.								9.	10.
15337....	♂	—	—	—	—	—	—	—	30	16.5.35–17.5.35
15399....	—	—	—	—	—	—	—	—	33	14.5.35–15.5.35
18449....	—	—	—	—	—	—	—	—	36	12.5.35–14.5.35
19444....	—	♂	—	—	—	—	—	—	33	16.5.35–17.5.35
19464....	♂	—	—	—	—	—	—	—	33	12.5.35–13.5.35
22027....	—	♂	—	—	—	—	—	—	36	13.5.35–14.5.35
22031....	—	—	—	—	—	—	—	—	27	14.5.35–15.5.35
22035....	—	—	—	—	—	—	—	—	24	15.5.35
25930....	—	—	—	—	—	—	—	—	24	13.5.35–15.5.35
25957....	—	—	—	—	—	—	—	—	24 (+ 4½ hrs.)	12.5.35–14.5.35
25961....	—	—	—	—	○	○	○	○	30 (+ 4½ hrs.)	17.5.35–18.5.35
26302....	—	—	—	—	○	○	○	○	48	16.5.35–18.5.35
32500....	—	—	—	—	—	—	—	—	—	(28.5.35)*
32546....	—	—	—	—	○	○	—	♂	57 (+ 1½ hrs.)	13.5.35–14.5.35
32554....	—	—	—	—	—	—	—	—	33	13.5.35–14.5.35
32657....	—	—	—	—	—	—	—	—	—	(11.5.35)*
32934....	—	—	—	—	—	—	—	—	24	12.5.35–13.5.35
32935....	—	—	—	—	—	—	—	—	27	14.5.35–15.5.35
33149....	—	—	—	—	—	—	—	—	27 (+ 1½ hrs.)	15.5.35–17.5.35
35966....	—	—	—	—	—	—	—	—	30	15.5.35–16.5.35
35968....	—	♂	—	—	—	—	—	—	33	14.5.35–15.5.35
36000....	—	—	—	—	—	—	—	—	30	14.5.35–15.5.35
36143....	—	—	—	—	—	—	—	—	21	13.5.35–14.5.35
36221....	—	—	—	—	—	—	—	—	21 (+ 4½ hrs.)	12.5.35–13.5.35
37064....	—	—	♂	♂	—	—	—	—	18	14.5.35–15.5.35
38083....	—	—	—	—	—	—	—	—	42	15.5.35–16.5.35
38464....	—	—	—	—	—	—	—	—	24	17.5.35–18.5.35
38516....	—	—	—	—	—	—	—	—	1	13.5.35–14.5.35
38528....	—	—	—	—	♂	—	—	—	18 (+ 1½ hrs.)	13.5.35–14.5.35
28545....	—	—	—	—	—	—	—	—	27	14.5.35–15.5.35
38546....	—	—	—	—	—	—	—	—	30	14.5.35–15.5.35
38557....	—	—	—	—	—	—	—	—	36	17.5.35–19.5.35
38558....	—	—	—	—	—	—	—	—	30	13.5.35–14.5.35
38560....	—	—	—	—	♂	—	—	—	18	15.5.35
39844....	—	—	—	—	—	—	—	—	30	12.5.35–14.5.35
39872....	—	—	—	—	—	—	—	—	39	15.5.35–17.5.35
40791....	—	—	—	—	—	—	—	—	33	15.5.35–16.5.35
43454....	—	—	—	—	—	—	—	—	33	15.5.35–16.5.35
43455....	—	—	—	—	—	—	—	—	24	14.5.35–15.5.35

Sheep No.	Times at which oestrus was observed. a.m. 3.	a.m. 6.	a.m. 9.	a.m. 12.	p.m. 3.	p.m. 6.	p.m. 9.	p.m. 12.	Duration of 2nd oestrus. (Hours.)	Dates.
1.	8.								9.	10.
15337....	—	—	—	—	—	—	—	—	30	16.5.35–17.5.35
15399....	—	—	—	—	—	—	—	—	33	14.5.35–15.5.35
18449....	—	—	—	—	—	—	—	—	36	12.5.35–14.5.35
19444....	—	—	—	—	—	—	—	—	33	16.5.35–17.5.35
19464....	—	—	—	—	—	—	—	—	33	12.5.35–13.5.35
22027....	—	—	—	—	—	—	—	—	36	13.5.35–14.5.35
22031....	—	—	—	—	—	—	—	—	27	14.5.35–15.5.35
22035....	—	—	—	—	—	—	—	—	24	15.5.35
25930....	—	—	—	—	—	—	—	—	24	13.5.35–15.5.35
25957....	—	—	—	—	—	—	—	—	24 (+ 4½ hrs.)	12.5.35–14.5.35
25961....	—	—	—	—	—	—	—	—	30 (+ 4½ hrs.)	17.5.35–18.5.35
26302....	—	—	—	—	—	—	—	—	48	16.5.35–18.5.35
32500....	—	—	—	—	—	—	—	—	—	(28.5.35)*
32546....	—	—	—	—	—	—	—	—	57 (+ 1½ hrs.)	13.5.35–14.5.35
32554....	—	—	—	—	—	—	—	—	33	13.5.35–14.5.35
32657....	—	—	—	—	—	—	—	—	—	(11.5.35)*
32934....	—	—	—	—	—	—	—	—	24	12.5.35–13.5.35
32935....	—	—	—	—	—	—	—	—	27	14.5.35–15.5.35
33149....	—	—	—	—	—	—	—	—	27 (+ 1½ hrs.)	15.5.35–17.5.35
35966....	—	—	—	—	—	—	—	—	30	15.5.35–16.5.35
35968....	—	—	—	—	—	—	—	—	33	14.5.35–15.5.35
36000....	—	—	—	—	—	—	—	—	30	14.5.35–15.5.35
36143....	—	—	—	—	—	—	—	—	21	13.5.35–14.5.35
36221....	—	—	—	—	—	—	—	—	21 (+ 4½ hrs.)	12.5.35–13.5.35
37064....	—	—	—	—	—	—	—	—	18	14.5.35–15.5.35
38083....	—	—	—	—	—	—	—	—	42	15.5.35–16.5.35
38464....	—	—	—	—	—	—	—	—	24	17.5.35–18.5.35
38516....	—	—	—	—	—	—	—	—	1	13.5.35–14.5.35
38528....	—	—	—	—	—	—	—	—	18 (+ 1½ hrs.)	13.5.35–14.5.35
28545....	—	—	—	—	—	—	—	—	27	14.5.35–15.5.35
38546....	—	—	—	—	—	—	—	—	30	14.5.35–15.5.35
38557....	—	—	—	—	—	—	—	—	36	17.5.35–19.5.35
38558....	—	—	—	—	—	—	—	—	30	13.5.35–14.5.35
38560....	—	—	—	—	—	—	—	—	18	15.5.35
39844....	—	—	—	—	—	—	—	—	30	12.5.35–14.5.35
39872....	—	—	—	—	—	—	—	—	39	15.5.35–17.5.35
40791....	—	—	—	—	—	—	—	—	33	15.5.35–16.5.35
43454....	—	—	—	—	—	—	—	—	33	15.5.35–16.5.35
43455....	—	—	—	—	—	—	—	—	24	14.5.35–15.5.35

* NOTE.—Sheep Nos. 32657 and 32500 were irregular in that their 2nd and 3rd exhibitions of oestrus

TABLE 1.

Dioestrum, and the Dioestrous Cycle in Merino Sheep.

Experiment 3.

Duration of 2nd oestrus. (Hours.)	Dates.	3rd Exhibition of oestrus. Times at which oestrus was observed. a.m. 3.	a.m. 6.	a.m. 9.	a.m. 12.	p.m. 3.	p.m. 6.	p.m. 9.	p.m. 12.	a.m. 3.	a.m. 6.	a.m. 9.	a.m. 12.	p.m. 3.	p.m. 6.	p.m. 9.	p.m. 12.	a.m. 3.	a.m. 6.	a.m. 9.	a.m. 12.	p.m. 3.	p.m. 6.	p.m. 9.	p.m. 12.	a.m. 3.	a.m. 6.	a.m. 9.	a.m. 12.	p.m. 3.	p.m. 6.	p.m. 9.	p.m. 12.	Duration of 3rd oestrus. Hours.	Duration of Dioestrum. Days.	Duration of Dioestrum. Hours.	Duration of Dioestrous Cycle. Days.	Duration of Dioestrous Cycle. Hours.
9.	10.				11.								12.								13.								14.					15.	16.	17.	18.	19.
30	16.5.35–17.5.35	—	—	○	○	○	○	○	○	○	○	○	○	○	○	♂	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	33	14	15	15	21
33	14.5.35–15.5.35	○	○	○	○	○	○	○	○	○	○	♂	○	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	27	15	15	17	0
36	12.5.35–14.5.35	—	—	—	—	○	○	○	○	○	○	○	○	○	♂	—	—	○	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—	42	11	0	12	12
33	16.5.35–17.5.35	—	—	—	○	○	○	○	○	○	○	○	○	♂	—	♂	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	30	16	12	17	21
33	12.5.35–13.5.35	—	—	—	○	○	○	○	○	○	○	○	○	♂	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	27	14	12	15	21
36	13.5.35–14.5.35	—	—	○	○	○	○	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	36	15	6	16	18
27	14.5.35–15.5.35	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	21	17	6	18	9
24	15.5.35	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	15	16	3	17	3
24	13.5.35–15.5.35	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	—	○	○	○	○	♂	—	—	—	—	—	—	—	—	—	—	—	36	14	21	15	21
24 (+ 4½ hrs.)	12.5.35–14.5.35	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	33	14	21 (+ 9)	16	6
30 (+ 4½ hrs.)	17.5.35–18.5.35	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	36	15	18 (+ 3)	17	9
48	16.5.35–18.5.35	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	45	15	6	17	6
—	(28.5.35)*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
57 (+ 1½ hrs.)	13.5.35–14.5.35	—	○	○	○	○	○	○	○	○	○	○	○	○	○	♂	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	39	14	9 (+ 3)	17	0
33	13.5.35–14.5.35	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	24 (+ 1½ hrs.)	15	0	16	9
—	(11.5.35)*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24	12.5.35–13.5.35	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	—	♂	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	30	15	21	16	21
27	14.5.35–15.5.35	—	○	○	○	○	○	○	○	○	○	♂	○	○	○	○	—	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	24 (+ 1½ hrs.)	15	15	16	18
27 (+ 1½ hrs.)	15.5.35–17.5.35	—	—	—	—	○	○	○	○	○	○	○	♂	○	○	○	—	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	42	15	6 (+ 3)	16	15
30	15.5.35–16.5.35	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	24 (+ 1½ hrs.)	16	15	17	21
33	14.5.35–15.5.35	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	30	15	12	16	21
30	14.5.35–15.5.35	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	30	15	0	16	6
21	13.5.35–14.5.35	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	27	15	15	16	12
21 (+ 4½ hrs.)	12.5.35–13.5.35	—	—	—	—	○	○	○	○	○	○	○	○	○	○	♂	—	♂	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	33	15	3 (+ 6)	16	12
18	14.5.35–15.5.35	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	—	♂	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	21	16	6	18	0
42	15.5.35–16.5.35	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	36	15	0	16	18
24	17.5.35–18.5.35	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	21	17	0	18	0
1	13.5.35–14.5.35	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	21	16	9	16	12
18 (+ 1½ hrs.)	13.5.35–14.5.35	—	—	—	—	○	○	○	○	○	○	○	○	♂	♂	♂	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	21 (+ 1½ hrs.)	15	15 (+ 3)	16	15
27	14.5.35–15.5.35	○	○	○	○	○	○	○	○	○	♂	○	○	♂	○	♂	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	24	15	9	16	12
30	14.5.35–15.5.35	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	18	15	6	16	12
36	17.5.35–19.5.35	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	—	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	48	15	6	16	18
30	13.5.35–14.5.35	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	21	15	15	16	21
18	15.5.35	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	15	16	12	17	6
30	12.5.35–14.5.35	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	36 (+ 1½ hrs.)	15	9	16	15
39	15.5.35–17.5.35	—	—	○	○	○	○	○	○	○	○	○	○	○	○	♂	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	45	15	12	17	3
33	15.5.35–16.5.35	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	21 (+ 1½ hrs.)	15	12	16	21
33	15.5.35–16.5.35	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	36	15	6	16	15
24	14.5.35–15.5.35	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	18	16	21	17	21

heir 2nd and 3rd exhibitions of oestrus fell beyond the period of intensive testing.

The preliminary, or first oestrus, was used merely as a guide to indicate the approximate date on which subsequent oestrus was likely to occur.

Table I, columns 4 and 10, 2nd and 3rd exhibitions of oestrus, contain the dates on which oestrus was observed during the intensive testing for oestrus, while the specific times of the duration of oestrus are indicated in the columns adjacent and to the right of the former columns. The signs which were explained in the previous section, indicate the presence, gradual passing off, and absence of oestrus.

In the columns of Table I containing the specific times of the duration of oestrus, it will be seen that certain oestrous periods were interrupted by the absence of oestrus at one or more periods of 3-hourly testing. In such cases, the uninterrupted period has been considered as the true duration, and the additional period or the resumption of oestrus is indicated in brackets (Table I ,columns 9 and 15).

The interrupted oestrous periods also cause inconsistency in the computation of dioestrum; in such cases dioestrum has been taken to extend from the complete cessation of oestrus up to the onset of the next oestrus (Table I, columns 16 and 17). However, the interrupting or non-oestrous periods occurring during the latter part of certain oestrous periods have been indicated in brackets (Table I, column 17) and they have been taken into account in the further analysis of the data. (Table II.)

The duration of the dioestrous cycle has been taken as the period from the onset of the second oestrus up to the onset of the third oestrus (Table I, columns 18 and 19).

The further analyses of the data presented in Table I are given in Tables II to V.

Discussion.

The Symptoms of Oestrus.—McKenzie and Phillips (1930) and Grant (1934) have indicated that the symptoms of heat in the ewe are less marked than in the cow (Hammond, 1927) and in the sow (McKenzie, 1926). The symptoms in Scottish sheep have been described in great detail by Grant, whose observations were made by means of a "keeled" ram.

The three-hourly observations made for obtaining the information reported in this experiment afforded ample opportunity for observing the mutual behaviour of ewes and rams or teasers. Most of the observations of Grant (1934) have been confirmed in the case of the Merino; however, the Merino ewe appears to be somewhat conservative in that, while some ewes may approach the ram and all ewes look back and vibrate their tails when the ram displays interest, no ewes have been observed to "pet" the ram before and after service, to lick his face, and to rub their heads against his side. However, the present author has seen a Merino approximately 12 hours in heat, butt a teaser serving another ewe.

TABLE II.

Frequencies of the Duration of Oestrus in Merino Sheep.

Hours	1–2	3–5	6–8	9–11	12–14	15–17	18–20	21–23	24–26	27–29	30–32	33–35	36–38	39–41	42–44	45–47	48–50	51–53	54–56	57–59	Total
Frequencies	1	0	0	0	0	2	5	9	10	7	11	10	9	2	3	2	2	0	0	1	74

TABLE III.

Frequencies of the Duration of Dioestrum in Merino Sheep.

Days and Hours	11–0	14–9	14–12	14–15	14–21	15–0	15–3	15–6	15–9	15–12	15–15	15–18	15–21	16–3	16–6	16–9	16–12	16–15	16–21	17–0	17–6	Total
Frequencies	1	1	1	1	2	3	1	6	2	3	5	1	1	1	1	1	2	1	1	1	1	37

TABLE IV.

Frequencies of the Duration of the Dioestrous Cycle in Merino Sheep.

Days and Hours	12–12	15–21	16–6	16–9	16–12	16–15	16–18	16–21	17–0	17–3	17–6	17–9	17–21	18–0	18–9	Total
Frequencies	1	3	2	1	5	4	4	4	2	2	2	1	3	2	1	37

TABLE V.

The Duration of the Phases of the Dioestrous Cycle.

	2nd and 3rd Oestrus Periods.				Dioestrum.				Dioestrous Cycle.	
	*a**	*b*	*c*	*d*	*e**		*f*			
Range of variation.....	hours 1–57	hours 1–58·5	hours 15–57	hours 15–58·5	days 11–0	hours 17–6	days —	hours —	days 12–12	hours 18–9
Mean.....	29·3	29·7	29·7	30·1	15	11·3	15	12·0	16	18·6

*NOTE: (*a*) The abnormal oestrus of one hour, sheep No. 38516, has been included and in cases in which oestrus was interrupted, only the uninterrupted period of oestrus was considered.

(*b*) The abnormal oestrus of one hour, Sheep No. 38516, has been included and in cases in which oestrus was interrupted, the period of oestrus following the interruption was included.

(*c*) The abnormal oestrus of one hour, Sheep 38516, has been omitted, and in cases in which oestrus was interrupted, only the uninterrupted period of oestrus was considered.

(*d*) The abnormal oestrus of one hour, Sheep No. 38516, has been omitted and in cases in which oestrus was interrupted, the period of oestrus following the interruption was included.

(*e*) In cases in which oestrus was interrupted, diostrum was computed from the time of the complete cessation of oestrus which excludes the period of the interruption of oestrus.

(*f*) In cases in which oestrus was interrupted, diostrum was computed from the time of the complete cessation of oestrus and the period of interruption was added.

Changes in the external genitalia of sheep in oestrus have been described by McKenzie and Philips (1930) and Grant (1934). Various degrees of congestion and swelling of the vulva have been noticed and in some cases the whole tail region is involved; the vulva are moist and sometimes a slight excretion of mucous occurs. The present author examined a large number of the Merino ewes reported upon in this experiment; the examinations were made at different stages of oestrus. In very few cases a slight indication of congestion was evidenced, but no marked swelling of the external labia of the vulva and the tail region was observed, nor was there any excretion of mucus. However, it may be remarked here that, during oestrous observations upon Border Leicester-Merino crossbreds, definite swelling of the vulva was noticable during oestrus and the excretion of mucus occurred. These symptoms of oestrus appear to be characteristic of the English and Scottish breeds and their crosses but not of the Merino.

Duration of Oestrus.—The details of the duration of oestrus are given in Table I, columns 4 to 8 and 10 to 14.

It is seen that in the case of Sheep Nos. 32500 and 32657, oestrus occurred beyond the periods of intensive testing.

The onset of 73 out of 74 periods of oestrus was abrupt. At the first testing for the duration of oestrus, Sheep No. 38516 showed signs of coming into oestrus for nine hours before oestrus was definitely present. However, the individual case cited was abnormal in that the sheep remained in oestrus for less than three hours (Table I, column 5). Grant (1934) observed the abrupt onset of oestrus in Scottish sheep, but McKenzie and Philips (1930) and Quinlan and Maré (1931) consider that oestrus comes on gradually for several hours. McKenzie and Philips state that the period of becoming receptive to the ram ranges from 0-15¼ hours.

The contention of Grant (1934) is upheld that the decision as to whether a ewe is receptive depends a great deal upon the persistency of the teaser. In all cases of doubt in this experiment, the most vigorous teaser was used. The author has seen a ewe walk out from a small group of ewes and teasers to a dividing fence beyond which the vigorous teaser was working; when the ewe was put through to the adjoining yard, she immediately stood for service by the vigorous teaser.

The observations of Grant (1934) and Quinlan and Maré (1931) that the passing off of oestrus is gradual have been confirmed in this experiment; however, the latter reveals considerable variation. The duration of two periods of heat of 37 sheep was studied. Out of a total of 74 heat periods, in approximately 42 per cent. of cases the termination of oestrus was abrupt; in approximately 36 per cent. of cases the passing off of oestrus was gradual and regular; in the remaining cases some or other form of interruption or irregularity occurred. The symbols used indicate that, in certain instances, sheep were found to be passing out of oestrus, or even definitely out of oestrus, for three or as long as nine hours, after which oestrus was observed to have returned. The gradual passing off of oestrus generally lasted for from three to six hours.

It is seen from Table II, that the range of variation of the duration of oestrus is considerable; the mode falls within the class of thirty to thirty-two hours; but in 77 per cent. of cases, the duration of oestrus is twenty-four hours and longer. The range of variation is given accurately in Table V; when only the uninterrupted periods are considered, the maximum duration is fifty-seven hours, and, with the exclusion of one exceptionally short period of less than three hours, the shortest duration of oestrus is fifteen hours. The mean varies according to the types of computations made, but the differences reflected are not great and means of approximately twenty-nine and thirty hours can be considered (see notes to Table V). These durations of oestrus are somewhat shorter than those observed by Quinlan and Maré (1931) in Merino sheep; the latter authors observed an average duration of forty hours, the shortest twenty-four hours, and the longest ninety-six hours. McKenzie and Philips (1930) found the mean duration of oestrus in Hampshires, Shropshires, and Southdowns to be 30·7, 26·3, and 24 hours respectively, while Grant (1934) has reported a period of 35 hours for Cheviots.

Duration of Dioestrum.—Dioestrum is the period from the cessation of oestrus up to the time of the commencement of the next oestrus.

Table III indicates the frequencies of the duration of dioestrum in Merino sheep. The range of variation is seen to be from 11 days to 17 days 6 hours and the mode is 15 days 6 hours. The mean duration of dioestrum is 15·5 days (Table V) and, in approximately 73 per cent. of cases, the duration of dioestrum exceeds 15 days.

Duration of the Dioestrous Cycle.—The periodicity of oestrus has been found to vary considerably (Quinlan and Maré, 1931 and McKenzie and Philips, 1930); dioestrous cycles as short as 6 and 7 days have been reported. The shortest cycle observed in this experiment is 12 days 12 hours, and the longest 18 days 9 hours (Table I columns 18 and 19); the mode is 16 days 12 hours (Table IV), and the mean 16 days 18·6 hours. In 51·4 per cent. of cases the duration of the dioestrous cycle is 16·5 to 17 days. The mean cycle is somewhat shorter than that reported by Quinlan and Maré (1931) for Merino sheep. McKenzie and Philips observed an average cycle of 16·6 days in Hampshires, Shropshires, and Southdowns, and Grant (1934) recorded a cycle of 16·4 days in Scottish breeds and crosses.

In the observations reported here, no cases of " silent " oestrus occurred. Hammond (1927) has suggested that in cattle such cases may be due to either abnormally short durations of oestrus which are missed when observations are made at 12 or 24 hour intervals, or that exceptionally feeble heat periods may be experienced. However, it appears that even when continuous testing with " keeled " rams is practised, in certain cases oestrus is not exhibited regularly at normal intervals. (McKenzie and Philips, 1930; Casida and McKenzie, 1932; Grant, 1934).

Conclusions.

1. The duration of oestrus, dioestrum, and the dioestrous cycle of 37 Merino ewes, was determined by testing for oestrus at three hourly intervals during the periods of heat and at twelve hour intervals during dioestrum.

2. The duration of oestrus varies considerably:—

(*a*) Abnormal periods of less than 3 hours duration may occur. Periods as long as 58·5 hours may be expected.

(*b*) The mode falls within the class 30 to 32 hours and in 77 per cent. of cases the duration of oestrus is 24 hours and over.

(*c*) The mean duration of oestrus is approximately 30 hours.

3. Appreciable variation of the length of dioestrum occurs:

(*a*) The range of variation extends from 11 days to 17 days 6 hours.

(*b*) The mode of the duration is 15 days 6 hours and in approximately 73 per cent. of cases dioestrum exceeds 15 days.

(*c*) The mean duration is 15·5 days.

4. Dioestrous cycles only of normal length occur:

(*a*) The range of variation extends from 12 days 12 hours to 18 days 9 hours.

(*b*) The mode of duration is 16·5 days, and in approximately 51 per cent. of cases oestrus recurs after 16·5 to 17 days.

(*c*) The mean duration of the dioestrous cycle is 16·8 days.

5. During oestrus, Merino sheep do not reveal marked swelling of the external labia of the vulva, nor is there any excretion of mucus.

6. The onset of oestrus in Merino sheep is abrupt.

7. The termination of oestrus in Merino sheep may be abrupt or gradual. On the other hand, oestrus may pass off completely or partially for from 3 to 9 hours at the end of the oestrous period, after which a resumption of oestrus may occur, the return of oestrus being definite or feeble and its renewed duration may be from 3 to 6 hours.

(*a*) In approximately 42 per cent. of cases, the termination of oestrus is abrupt.

(*b*) In approximately 36 per cent. of cases, the passing off of oestrus is gradual.

(*c*) In approximately 22 per cent. of cases, the latter portion of the oestrous period is interrupted by the total absence of oestrus or by the exhibition of " feeble " oestrus.

EXPERIMENT 4.

The Period of the Absence of Oestrus after Parturition in Merino Sheep.

The duration of the period of sexual inactivity after parturition is of considerable practical interest. This phase of the subject of ovarian activity has received attention by certain investigators.

Oestrus has been observed to occur 24 hours after abortion (Nichols, 1924). Normal oestrus has been observed in Merino ewes 17 and 21 days after the birth of still-born lambs by Quinlan and Maré (1931) and van Rensburg (1935). The former authors have found that ovulation may occur 10 to 15 days post partum.

Preliminary observations made by the author, indicated that the duration of the period of sexual inactivity after lambing in Merino sheep was prolonged under the conditions of the eastern Transvaal.

In farm practice, the procedure is to regulate lambing to occur at a time when natural conditions are most favourable. When lambing takes place during the spring months, pasture is abundant, but heavy infections of young lambs with internal parasites have caused greater preference to be given to autumn lambing in Merino studs and flocks. The problem of changing over from spring to autumn lambing appears to be one of great practical interest in certain areas. The postponement of mating from the autumn to the spring would mean the loss of 7 to 8 months, so that the possibility of rapid alteration of the mating season would depend entirely upon the onset of sexual activity after lambing.

The object of this experiment was to determine the duration of the period of the absence of oestrus after parturition when lactation is terminated by early weaning and when lactation is allowed its normal course.

Materials and Methods.—Three groups of mature Merino ewes, which had lambed the year previous to their inclusion in the experiment, were used for the observations. Preliminary observations were made on 13 sheep in Group I which lambed during July and August, 1931; further observations were made on 9 sheep in each of Groups II and III, which lambed during September, 1933. The sheep in Group II were ewes the lambs of which had died within three days after birth. The lambs of Groups I and III were weaned when they were $4\frac{1}{4}$ to 5 months of age.

Due to the lack of green winter pasture, the ewes in Group I were fed 6 ounces of maize with maize silage and teff hay. As spring pasture became available, the feed was decreased and, eventually, withheld; the feeding of silage was discontinued on 1.10.31, and the remaining feeds were withdrawn on 20.10.31.

Groups II and III were grazed on green oats for two months prior to the commencement of lambing and fresh spring pasture became available during the first week of September, or soon after the sheep started lambing.

A lick consisting of two parts of bonemeal and one part of salt was self-fed to all groups. The general methods of management, indicated under the corresponding section of Experiment 1, were applied to these groups.

No weight records were taken of Group I. Groups II and III were weighed after 12 to 14 hours starvation at 14 day intervals; in the former case, weighing was commenced approximately one month after lambing, and, in the case of Group III, about two months after lambing.

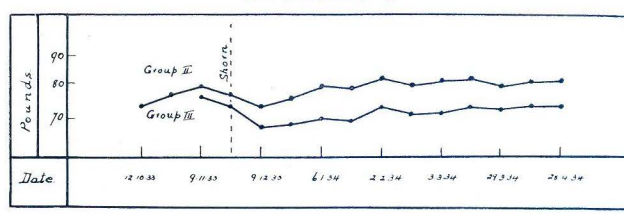
The groups were grazed near the observation yards to which they were brought daily for oestrous observations. Oestrous observations on Group I were continued for only a month after sexual activity had commenced; during this period all the sheep had exhibited oestrus; the occurences of oestrus other than the first were not considered. In the case of Groups II and III, oestrous observations were continued for several months of the sexual season, or until the majority of the members of the groups had completed several dioestrous cycles. The observations on the latter two groups were discontinued on 30.4.34, but individuals that had not shown oestrus by that date were kept under daily observation for oestrus until such time as oestrus was exhibited. Three sheep in Group III failed to show oestrus throughout the entire period of the observations; they were, eventually, slaughtered for macroscopic examination of their ovaries.

Results.

The weight records of Groups II and III are given in Appendix 3, Tables I and II. The average weights of the groups have been computed and from these the accompanying Diagram 3 has been constructed.

DIAGRAM 3.

EXPERIMENT 4.



Mean weight of groups at 14 day intervals.

The results of the oestrous observations on Groups II and III are given in Appendix 3, Tables III and IV. The sexual histories of individual ewes in Groups I, II, and III are given in Tables I, II and III respectively of the text.

Table I.

Group I.

The Sexual History of Breeding Ewes.

Sheep No.	Date of lambing.	Date of first oestrus.	Period between lambing and first oestrus.	Period between lambing and termination of observations.	
				Duration.	No. of dioestrous cycles.
			days.	days.	
368	3.8.31	22.2.32	203	—	—
100	10.8.31	4.3.32	207	—	—
13413	25.8.31	23.2.32	182	—	—
15356	18.8.31	4.3.32	199	—	—
18443	11.8.31	15.2.32	188	—	—
19432	6.8.31	23.2.32	201	—	—
21495	7.8.31	19.3.32	225	—	—
21519	27.7.31	16.2.32	204	—	—
21658	15.8.31	18.2.32	187	—	—
25873	10.8.31	23.2.32	197	—	—
25921	8.8.31	15.3.32	220	—	—
25930	10.8.31	7.3.32	210	—	—
25944	15.8.31	24.2.32	193	—	—
Total	—	—	2616	—	—
Average	—	—	201·2	—	—

Table II.

Group II.

			days.	days.	
25914	2.9.33	5.11.33	64	240	9
22031	8.9.33	13.1.34	127	234	5
22035	17.9.33	3.1.34	108	225	7
35610	22.9.33	18.2.34	149	220	4
35659	8.9.33	1.3.34	174	234	3
35701	18.9.33	10.5.34	234	234	1
35741	7.9.33	7.2.34	153	235	4
35755	18.9.33	19.1.34	123	224	6
35978	29.9.33	10.12.33	72	213	8
Total	—	—	1204	2059	47
Average	—	—	133·8	228·8	5·2

TABLE III.

Group III.

Sheep No.	Date of lambing.	Date of first oestrus.	Period between lambing and first oestrus.	Period between lambing and termination of observations.	
				Duration.	No. of dioestrous cycles.
18449	20.9.33	11.2.34	144	222	5
35628	9.9.33	16.2.34	160	233	2
35656	2.9.33	(no oestrus)	—	347	Slaughtered : 15.8.34
35706	13.9.33	(no oestrus)	—	352	Slaughtered : 22.6.34
35712	29.9.33	13.3.34	165	213	3
35731	10.9.33	(no oestrus)	—	355	Slaughtered : 22.6.34
35734	2.9.33	22.2.34	173	240	5
38518	20.9.33	5.1.34	107	222	6
38521	28.9.33	18.3.34	171	214	2
Total	—	—	920	1344	23
Average	—	—	154·0	224·0	3·8

It will be noticed in Appendix 3, Tables III and IV, that four sheep, Group II, No. 35701, and Group III, Nos. 35656, 35706, and 35731, did not show oestrus during the period of oestrous observations. The observations on these sheep were extended and Sheep No. 35701 eventually showed oestrus after a total period of 234 days (Table II). The remaining three sheep did not show oestrus after a total period of testing of 347 and 355 days (Table III); these sheep were slaughtered for the examination of their ovaries on the dates indicated in the latter table, and the results of such examinations are given in Appendix 3A, from which Table IV of the text has been constructed.

Discussion.

In the case of Group I, the lambs were born during the month of August (1931) and they were weaned when 135 to 150 days old (Table I). The lambs of Group II and III were born during September (1933); those of Group II died within the first week after birth while those of Group III were weaned when 135-150 days old.

Although no weight records were taken of the Group I ewes, it was recorded that the sheep showed satisfactory improvement of condition during the period of observation. From the weight records of Groups II and III (Appendix 3, Tables I and II), from which Diagram 3 has been constructed, it will be seen that the Group II sheep show an immediate recovery in weight after lambing, and, although a slight drop in weight occurs before shearing, very rapid improvement takes place after shearing. From the beginning of February, a more or less constant weight is maintained. The sheep

TABLE IV.

The Examination of Ovaries of Inactive Sheep.

Sheep. No.	Age.	Condition.	Weight.	Period between lambing and date of slaughter	Ovaries.				*Graafian follicles.*			*Corpora Lutea.*	
					Left.		Right.		No observed.		Largest.	I.	II.
					Weight.	Size.	Weight.	Size.	Left. ovary.	Right. ovary.			
	years.		lb.	days.	gm.	cm.	gm.	cm.			cm.	cm.	cm.
35706	6	Good	75·0	352	0·55	1·5×1·0×0·7	0·97	1·7×1·0×0·9	2	1	0·4	1·0×0·9	0
35731	6	Fair.	66·5	355	0·56	1·5×1·0×0·7	0·60	1·2×1·2×0·7	2	2	0·3	0	0
35656	8	Poor	66·0	347	0·89	1·8×1·2×0·7	0·48	1·4×0·9×0·7	5	7	0·5	0	0

in Group III do not recover so rapidly after shearing, and, in spite of the fact that their lambs had been weaned at the beginning of February, they also maintain a more or less constant weight from the beginning of that month. The difference in weight is 3 pounds in favour of Group II at the beginning of November, 1933, but at the time of the termination of the observations, at the end of April 1934, the difference in weight increases to 9 pounds. As the sheep in Group III were in fair to good condition, the lighter weight of these sheep cannot be considered to have affected their sexual activity (Experiment 1A).

The occurrences of oestrus of Groups II and III are given in Appendix 3, Tables III and IV. It is seen that several of the sheep in Group II started showing oestrus before those in Group III, and that greater sexual activity was exhibited in both groups from February, or when the sheep showed no further improvement in condition.

The sexual histories of the sheep in Groups I, II, and III have been summarised and presented in Tables I, II, and III of the text.

It is seen that the sheep in Group I were sexually inactive during the period of rearing their lambs and for approximately 50 days beyond this period. The period of sexual inactivity after parturition ranges from 182 to 225 days, the average duration being approximately 201 days. The sheep in Group III had received similar treatment with respect to the weaning of lambs. In this case, the range of variation of the period of sexual inactivity after parturition is 107 to 173 days, but only approximately 67 per cent. of the group had shown oestrus, although oestrous observations on the remainder had been extended for close on a year. In Group III, the average duration of the inactive period is 154 days or approximately the length of the lactation period. No explanation can be given for the longer period of inactivity experienced by the sheep in Group I.

In the case of Group II, the lambs of which had been weaned almost immediately after parturition, the range of variation of the duration of the sexually inactive period is 64 to 234 days, the average being 133·8 days. The latter figure is greatly influenced by one case in which the inactive period is 234 days.

The increased sexual activity of Group II as compared to Group III, is further indicated by the number of dioestrous cycles experienced. In Group II, the cycles range from 1 to 9, the average being 5·2 cycles during an average period of 228·8 days, while in Group III, the range is from 2 to 6, the average being 3·8 cycles during an average period of 224 days.

The results of the examinations of the ovaries of the three inactive sheep in Group III indicate, that one sheep had ovulated recently, as a large corpus luteum was present. The numbers of Graafian follicles readily distinguishable in the ovaries of these sheep are small (Table IV). The details of the macroscopic examinations of the ovaries are given in Appendix 3a.

It appears from the above results that, in cases in which lactation is allowed to run its normal course, the onset of sexual activity is later than in cases in which lactation is terminated at an early stage.

In connection with the influence of lactation upon ovarian activity, Parkes (1929) has demonstrated by practising ovariectomy, that the inhibition of oestrus during lactation is set up through the ovary and that the absence of oestrus is not due to the heavy drain upon the metabolism resulting from lactation. Crew and Mirskaia (1930 a), reporting upon the reproductive rate in the mouse, indicate that the non-suckling female is capable of giving birth to twice as many offspring in a given period of time as can the suckling mouse. Crew and Mirskaia (1930 b), in discussing the lactation interval in the mouse, contend that "suckling is the agent primarily responsible for the maintainance of the lactation interval, and, when it is removed, no matter at what stage of the interval, the interval terminates and the oestrous phases replace the reproductive". It is further contended, that the transformation of the corpus luteum of pregnancy to that of lactation is brought about by the action of the pituitary to the stimulus of suckling and that, endocrimologically, the conditions of pregnancy and of lactation are very similar, if not identical.

The detailed studies of Quinlan and Maré (1931) on the changes in the ovary of Merino sheep during pregnancy and early lactation indicate that, immediately after parturition, there is a rapid decrease in the size of the corpus luteum vera, and that one or more Graafian follicles rapidly develop in preparation for the first post-parturition ovulation. These authors state that, while ovulation may occur 10 to 15 days following normal parturition, such ovulation is not accompanied as a rule by the physiological exhibition of heat when the ewe suckles her lamb. It will be revealed in a later section of this thesis, that, in certain cases, normal oestrus and ovulation may occur during the early stages of lactation in Merino ewes (Part 2, A). It may be remarked here that it is the practice of certain Merino stud breeders to wean the lambs at 3 months of age; the purpose of this procedure is to permit the ewes a longer period of rest in preparation for the next mating season.

The following facts have not been established with regard to Merino sheep:

(1) Whether, as a general rule, spurious ovulations occur during the early stages of lactation.

(2) At what stage of lactation normal oestrus and ovulation occur in areas where continuous sexual activity is experienced throughout the year, and whether, in such areas, the onset of sexual activity is hastened by the early termination of lactation.

(3) Whether the changes in the ovary after parturition differ in areas where a part of the period of parturition and the whole of lactation occupy the period equivalent to that of anoestrum in the non-pregnant ewe.

(4) Whether, in areas where a prolonged anoestrous period is experienced, the period of time before the onset of ovarian activity differs when lambing occurs during the autumn rather than during the spring.

Conclusions.

1. Observations upon the onset of sexual activity after parturition were made with 22 Merino ewes, the lambs of which were weaned at approximately 5 months of age, and with 9 Merino ewes the lambs of which had died within 7 days of birth.

2. Sheep that lamb during the spring and that are allowed to rear their lambs to the age of 5 months do not exhibit oestrus during lactation.

Although in relatively few cases oestrus may be exhibited as soon as 3·5 months after parturition, in approximately 87 per cent. of cases the period during which oestrus remains absent exceeds 150 days.

3. Sheep that lamb during the spring and the lambs of which are weaned immediately, experience a relatively short inactive period after parturition.

In such cases, oestrus may be expected to occur 2 months after parturition, and in 67 per cent. of cases the onset of sexual activity occurs within 150 days after parturition. Once sexual activity has commenced, normal dioestrous cycles occur.

4. In cases of prolonged inactivity, the ovaries may be in a quiescent state, or occasional spurious ovulation may occur.

5. The presence of suckling delays the onset of the sexual season, although the absence of lactation does not entirely eliminate the anoestrous period experienced by sheep which lamb in the spring under eastern Transvaal conditions.

EXPERIMENT 5.

The Sexual Season of Crossbred Sheep.

The restricted annual sexual activity of Merino sheep reported in the preceding experiments, led to a consideration of the sexual activity of certain crossbred sheep available at the Experiment Station, namely, Suffolk-Blackhead Persians and Blackhead Persian-Merinos.

The Suffolk, like most British breeds of sheep, experiences a restricted annual sexual season in its home country and abroad (Heape, 1900, Marshall, 1903, 1922, Roberts, 1921, Cole and Miller, 1933). Evidence is produced in a subsequent section of this thesis which indicates that, in the southern hemisphere, the sexual season of the British breeds of sheep conforms to the new order of the seasons of the year (Part 2, B). The Blackhead Persian is a hardy breed of sheep which has been found to be well suited to the semi-arid areas of this country. The owners of this breed maintain that these sheep are capable of being bred at any time of the year, which would indicate the existence of an extreme degree of polyoestrum. In general, crossbred sheep are early maturing and exhibit great vigour; in these respects they excel the slower maturing and less vigorous Merino.

The object of the experiment was to observe the extent of annual sexual activity exhibited by Suffolk-Blackhead Persian and Blackhead Persian-Merino crossbred sheep, and to compare the sexual activity of these crossbreds with that of Merino sheep.

Materials and Methods.—Two groups, each consisting of ten ewes, were drafted at random from the two types of crossbreds available. Observation were commenced on May 25th, 1933, and terminated on May 29th, 1934.

The Suffolk-Blackhead Persian sheep comprising Group I were mature, and they had lambed the previous season. The Blackhead Persian-Merino sheep, Group II, were bred on the Experiment Station, and they were 9 to 10 months old when they were drafted into the experiment. The Merino sheep used for the purpose of comparison constituted Group VI, Experiment 1A; this group is referred to in this experiment as Group III.

The sheep were weighed at fortnightly intervals and oestrous observations were conducted once daily. The procedure in recording these observations was identical to that given in the preceding experiments reported here.

The general management of the sheep was similar to that of the groups of sheep in Experiment 1A and it was identical in every particular to the treatment of Group VI, Experiment 1A, in that the two groups of crossbred sheep were maintained on the same natural pasture supplemented throughout the year only by a mineral lick consisting of two parts of bonemeal and one part of salt.

Result.

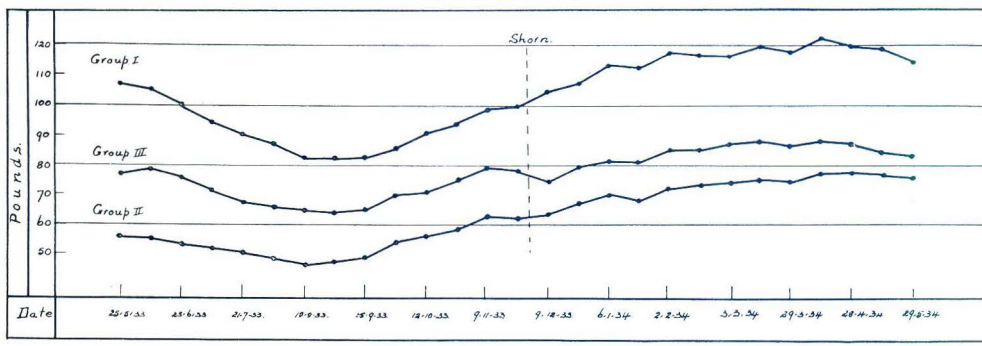
The weight records of Groups I and II, taken at 14 day intervals, are given in Appendix 4, Tables I and II. The average weights have been computed and from these Diagram 4 has been constructed. The weight curve of Group III has been constructed from the weight data of this group given in Appendix 1A, Table VI.

The oestrous observations and sexual seasons of Groups I, II, and III are given in Appendix 4, Tables III, IV, and V. In the case of Table V, the data have been taken from Appendix 1, Table XIV; only the observations for the identical period of Groups I and II have been considered, that is from 24.5.33 to 29.5.34.

Table I of the text, indicating the seasonal sexual activity of the three groups of sheep, has been constructed from Appendix 4, Tables III, IV, and V. Table II of the text giving the frequencies of the periodicity of oestrus has been compiled from data in the latter three tables.

DIAGRAM 4.

EXPERIMENT 5.



Mean weights of groups at 14 day intervals.

Photographs of Groups I and II are given in Figs. 22 and 23, and photographs of Group III are given in Figs. 11 and 12 (Experiment 1A).

Discussion.

The weight curves illustrate the reaction of the three different types of sheep in Groups I, II, and III to the changes in the natural pasture as affected by the seasons (Diagram 4).

The mature Suffolk-Persian crossbreds, comprising Group I, lost 23·8 per cent. in weight from 25.5.33 to 18.8.33, or a period of 85 days, and, although they did not recover this loss after an equivalent period, the difference between the lowest mean winter weight and the highest mean summer weight reveals, that the sheep gained 48·6 per cent. on the former weight during a period of 239 days (Appendix 4, Table I).

The young Blackhead Persian-Merino crossbreds, comprising Group II, lost 17·4 per cent. in weight during the period of 85 days, and the difference between the lowest mean winter weight and the highest mean summer weight reveals, that the sheep gained 62·9 per cent on the former weight during a period of 239 days (Appendix 4, Table II).

TABLE I.

The Sexual season of Crossbred and Merino Sheep.

Group.	Sexual Season, 1933. May to August.			Anoestrous Period, 1933–1934. September to January.		Sexual Season, 1934. February to May.		
	No. of sexually active sheep.	No. of dioestrous cycles.		Duration (days).		No. of sexually active sheep.	No. of dioestrous cycles.	
		Range.	Average.	Range.	Average.		Range.	Average.
I.....	10	3—6	4·30	205.-246	226·?	10	4—7	5·6
II.....	4	0—4	1·75	195—289+	237·5+	10	2—9	6·3
III*.....	10	1—5	3·90	118—341	204·4	9	1—7	5·2

* NOTE :—Group III is a group of Merino ewes, included for comparative purposes.

TABLE II.

Frequencies of the Periodicity of Oestrus.

Days.	Sexual Season, 1933.									Sexual Season, 1934.													Sexual Seasons, 1933 and 1934.															Total.
	15	16	17	18	19	33	34	35	36	15	16	17	18	19	20	32	33	35	38	52	54	74	15	16	17	18	19	20	32	33	34	35	36	38	52	54	74	
Group I.....	4	8	15	4	1	1	—	—	—	6	25	12	1	1	—	1	—	—	—	—	—	—	10	33	27	5	2	—	1	1	—	—	—	—	—	—	—	79
Group II.....	—	—	2	1	—	—	—	—	—	—	3	22	16	5	1	—	—	2	1	1	1	1	—	3	24	17	5	1	—	—	—	2	—	1	1	1	1	56
Group III.....	—	1	8	14	3	—	1	1	1	—	2	14	15	—	1	—	1	4	—	—	—	—	—	3	22	29	3	1	—	1	1	5	1	—	—	—	—	66

The mature Merino sheep, comprising Group III, lost 15·6 per cent. in weight during a period of 99 days, and the difference between the lowest mean winter weight and the highest mean summer weight reveals, that the sheep gained 36·0 per cent. on the former weight during a period of 225 days (Experiment 1A, Appendix 1, Table VI).

As the sheep in Group II were young, their weight reactions cannot be compared with those of the mature sheep in Groups I and III. In the cases of the latter two groups, it is apparent that the Suffolk-Persian crossbreds decline more rapidly and to a comparatively lower weight level under winter conditions than do Merinos.

It is seen from the results of the oestrous observations (Appendix 4, Tables III, IV, and V), that all three groups of sheep experienced a marked and prolonged anoestrous period. In the case of mature crossbreds the 1933, sexual season may be considered to extend up to the end of July, although two cases of sexual activity occur during August. In the Merinos, the sexual season is 2 to 3 weeks longer. Only 40 per cent. of the young Blackhead Persian-Merino crossbreds exhibited oestrus when from 10 to 12 months of age, and only in one case was more than one dioestrous cycle observed.

The onset of the 1934 sexual season is somewhat earlier in the young crossbred sheep, while in the mature Suffolk-Persian crossbreds the onset of the season is approximately 2 to 3 weeks later than in the Merino sheep.

In general, it may be stated that, in spite of excessive loss of condition or body weight, the sheep continue to exhibit sexual activity until the lowest winter weight is reached. During the anoestrous period, rapid increase in body weight takes place, but the sexual season commences only when a high level weight is attained.

Summaries of the details of the sexual seasons of the three groups are presented in Table I of the text. The mature crossbreds show greater sexual activity than the Merinos during the two portions of the sexual seasons, in that a larger number of dioestrous cycles were experienced by them. The duration of the anoestrous period is longer in Suffolk-Persian crossbreds than in Merinos.

It will be shown in a subsequent experiment (Experiment 6) that Merino flock sheep do not exhibit oestrus at 10 to 12 months of age, and as 40 per cent. of Blackhead Persian-Merino crosses exhibited oestrus at that age, it may be said that these crossbreds are somewhat earlier maturing with respect to sexual activity than Merinos (Table I). However, although the Blackhead Persian is contended to experience continuous annual sexual activity (Part 2 B), the resultant cross of this breed with the Merino experiences a prolonged anoestrous period corresponding to that of Merinos under eastern Transvaal conditions. The Blackhead Persian-Merino crosses show remarkable sexual activity when 22 to 24 months old; during the 1934 sexual season these crossbreds experienced an average of 6·3 dioestrous cycles, whereas mature Suffolk-Blackhead Persians and Merinos experienced an average of 5·6 and 5·2 dioestrous cycles respectively during the same season.

The frequencies of the periodicity of oestrus of the three groups of sheep are given in Table II of the text. Considering the two portions of the sexual seasons of 1933 and 1934, it is seen that, in the case of the Suffolk-Blackhead Persian crosses, the mode of the dioestrous cycles is 16 days, and in 76 per cent. of cases oestrus recurred after 16 and 17 days. In the case of the Bleackhead Persian-Merino crossbreds, the mode is 17 days, and, in 73 per cent. of cases, oestrus recurred after 17 and 18 days. In the case of the Merino sheep, the mode is 18 days, and, in 77 per cent. of cases, oestrus recurred after 17 and 18 days.

It appears from the above, that the genetic influence of the Suffolk in the Suffolk-Merino cross is to lengthen the anoestrous period by about one month and to shorten the duration of the dioestrous cycles. Grant (1934) draws attention to the differences of the duration of the dioestrous cycles in Merinos and in English and Scottish breeds of sheep.

Conclusions.

1. The sexual seasons of Suffolk-Blackhead Persian and Blackhead Persian-Merino crossbred sheep were compared with that of Merino sheep over a period of 12 months.

2. Crossbred sheep react more severely to declining pasture conditions during the autumn and winter months than do Merinos, but the former sheep increase more rapidly in condition during the spring and early summer months than do Merinos.

3. Crossbreds of the types mentioned experience a prolonged anoestrous period during the spring and early summer months under eastern Transvaal conditions; this anoestrum occurs during the same seasons as that evidenced in Merino sheep. Sexual activity persists in spite of declining body weight, and the anoestrous period corresponds to the period during which the greatest increase in body weight occurs.

4. The sexual season of Suffolk-Blackhead Persian crossbreds is 4 to 6 weeks shorter than that of Merinos.

5. The onset of the sexual season of Blackhead Persian-Merino crossbreds occurs approximately one month earlier than that of Merino sheep.

6. Blackhead Persian-Merino crossbreds are more early maturing with respect to sexual activity than Merinos.

7. The mode of the dioestrous cycles in Suffolk-Blackhead Persian crossbreds is 16 days, in Blackhead Persian-Merino crossbreds 17 days, and in Merinos 18 days.

8. The differences in the length of the sexual season, early maturity, and the duration of the dioestrous cycle are considered to be due to genetic factors.

EXPERIMENT 5.

Fig. 22.—Group I: 16.9.33.

Fig. 23.—Group II: 16.9.33.

EXPERIMENT 6.

A. The Age of Puberty of Merino and Crossbred Sheep.

The methods of sheep husbandry employed in the eastern districts of the Transvaal have been discussed in the introduction of this thesis. Internal parasites and the low nutritive value of the pastures constitute the greatest problems confronting sheep farmers. The greatest inhibition of growth in sheep occurs during the first twelve months of life. It has been stated that autumn lambing rather than spring lambing has been found by sheepmen to permit better growth in young sheep, as the latter are many months old when worm infection is at its worst during the wet and warm summer months. Yet, many farmers do obtain spring born lambs, the cost of rearing which should be less than the rearing of autumn born lambs, due to the increased amount of feed necessary in the case of the latter. Moreover, the experience of many farmers in the eastern Transvaal is that a large percentage of ewes are more partial to lambing in the spring.

The problems involving the rearing of spring-born lambs under eastern Transvaal conditions have received some attention at the Research Station, Ermelo (Roux and van Rensburg, 1935). At present, it appears that infection with internal parasites, especially tape worm (*Monezia expansa*), overshadows all other problems. The studies on the growth of lambs at the Research Station led to a consideration of the sexual maturity of young sheep.

The earliest age at which ewes can be bred is of considerable economic importance, especially in the case of crossbred (or half-bred) ewes of rapid growing, large framed type, such as the Border Leicester-Merino, which, in a particular system of crossbreeding, may be retained for further crossing. Provided body development results in a satisfactory size, it would be an advantage to breed such sheep as early in life as possible in order to obtain maximum returns by lengthening the life period of reproduction.

The object of the experiment was to determine the age of puberty of Merinos and Border Leicester-Merino crossbreds, and to ascertain the age at which such sheep can be bred under eastern Transvaal conditions of management comparable to those of well managed commercial flocks of the area.

Materials and Methods.—Twenty Merinos and twenty Border Leicester-Merino crossbreds were used in the experiment. These sheep were drafted at random, at the age of 4½ to 5 months, from the ewe lambs bred in connection with crossbreeding experiments conducted at the Research Station during the spring lambing seasons of 1933 and 1934. The following groups, each consisting of 10 sheep, were constructed for the experiment:—

Group I : Border Leicester-Merino Crossbreds, 1933.
Group II : Merinos, 1933.
Group III : Border Leicester-Merino Crossbreds, 1934.
Group IV : Merinos, 1934.

The treatment of the pregnant ewes for the 1933 and 1934 lambings did not vary, although the latter season is considered to have been a somewhat better sheep year. In each case, six weeks prior to lambing, the ewes were given green oat grazing for about two hours daily. A lick of two parts bonemeal and one part salt was self-fed at all times prior to and subsequent to lambing; the lambs had access to the lick.

The Merino and crossbred lambs of each season were run together with their dams in one flock. After weaning, the two types of lambs of each season received identical treatment.

Due to the unsatisfactory growth reflected by the 1933 season lambs, alterations in management were introduced in the case of the following season's lambs. The former lambs were dosed with the Government Wireworm Remedy at three weekly intervals from the age of one month. No supplementary feed apart from oat grazing was given the 1933 season lambs. In December, when the lambs were approximately 2½ months old, they were found to be badly infected with tape worm, and great difficulty was experienced in ridding the sheep of the infection before the end of the summer. When the sheep were about 7 months old, it was considered necessary to supplement the grazing with 4 ounces of maize per sheep per day, the feeding of which was commenced on 30.5.34. In addition, the sheep were put on to green oat grazing for 1 to 2 hours daily from 23.6.34. Small amounts of green veld grazing became available to the sheep during the first week of August, 1934, and, during the latter part of this month, green veld grazing was abundant. Supplementary feeding was discontinued after 15.8.34. During the next winter (1935) supplementary feeding of green oat grazing and 4 ounces of maize was commenced on 7.5.35 and continued up to 17.8.35, when, due to heavy grazing and adverse winter conditions, the sheep had to be removed, kept on dry pasture, and fed 6 ounces of maize per sheep per day.

The 1934 season lambs were dosed for gastric and intestinal worms at 2 and 3 weekly intervals from about 3 weeks of age. Treatment with nicotine and copper sulphate for tape worms as recommended by Mönnig (1932) was tried with only partial success.

When the lambs were approximately two months old, an attempt was made to supplement the veld and green oat grazing with maize, fed by the lamb-creep system. The lambs did not take to such feeding readily and, during the first few months, insignificant quantities of feed were consumed. However, by the time the lambs were weaned, 4 ounces of maize were being fed per sheep. On May 7th, 1935, the sheep were put on to green oat grazing for 1-2 hours daily, and they were fed 4 ounces of maize per sheep per day together with the 1933 season lambs. From that date both seasons' lambs received similar treatment.

All the sheep in this experiment were weighed at birth and at three weekly intervals up to the age of five months; subsequently, weights were recorded less frequently. Up to 2 months of age the lambs were starved for 4 hours before being weighed, but after 2 months they were starved for 12 to 14 hours before being weighed.

All sheep were tested for oestrus daily from the time of weaning, or when they were $4\frac{1}{2}$ to 5 months of age; vasectomised teasers were used for oestrous observations. The sheep were grazed as near the observation yards as possible; the distance to the grazing camps did not exceed half-a-mile.

General farm practices such as inoculation, shearing, and dipping, were followed with these sheep.

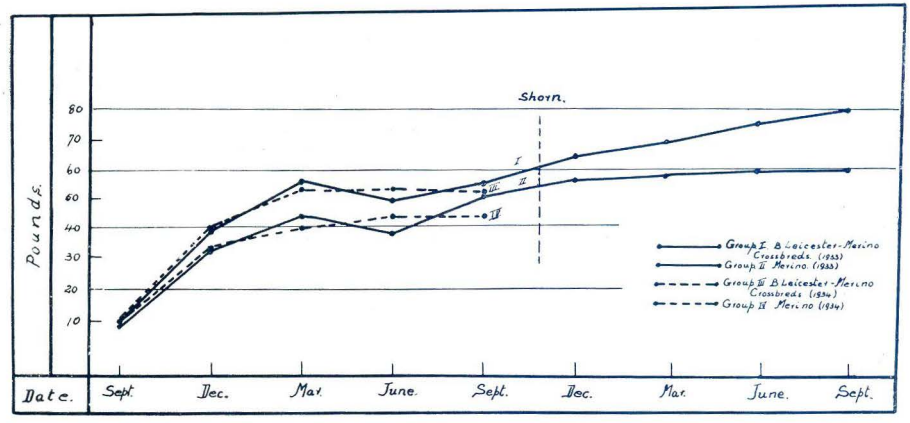
Results.

The birth weights and subsequent weights at three-monthly intervals of Groups I to IV are given in Appendix 5, Tables I to IV.

The accompanying Diagram 5 has been constructed from the mean weights given in the above tables.

DIAGRAM 5.

EXPERIMENT 6.



Mean weights of groups at 3 monthly intervals.

The results of the oestrous observations upon Groups I and II up to September 30th., 1935, are given in Tables I and II of the text.

From the time of the commencement of oestrous observations up to September 30th., 1935, no occurrences of oestrus were observed in Groups III and IV.

Table III has been constructed from Tables I and II to indicate the average of the groups; the frequencies of the periodicity of oestrus have been attached to the table.

It is of interest to note the results of shearing 12 months growth from the 1933 Merinos and crossbreds. The Border Leicester-Merino crossbreds grew staples of 2 to $2\frac{3}{4}$ inches in length, the wool varied from a 58's to a 64's quality, and the range of variation in the total grease yield was from 1·5 to 3·8 lb., the average being 2·6 lb. In the case of the Merinos, the staple lengths varied from $1\frac{1}{4}$ to 2 inches, the quality from a 64's to an 80's, and the range of variation of the total grease yield was from 2·8 to 4·7 lb., the average being 3·8 lb.

Photographs of the four groups are given in Figs. 24 to 27.

Table I.

The Age of Puberty of Crossbred and Merino Sheep.

Group I: Border Leicester-Merino Crossbreds (1933).

Sheep No.	Date of birth.	Age at 1st oestrus.	1935 Occurrences of oestrus.								No. of dioestrous cycles.	Length of sexual season.	Periodicity of oestrus (days).					
			Feb.	March.	April.	May.	June.	July.	August.	Sept.								
		days.										days.						
38320	21.9.33	572	—	—	,16	1, 17	3,	—	—	—	4	49	15	16	17			
38321	8.9.33	599	—	—	,30	,16	1, 18	—	—	—	4	50	16	16	17			
38342	30.8.33	565	—	,18	,18	5, 21	6,23	—	—	—	6	98	31	17	16	16	16	
38374	11.9.33	578	—	—	12, 29	—	3, 21	—	—	—	4	71	17	35	18			
38385	14.9.33	556	—	,24	10, 27	13,30	,16	3,	—	—	7	102	17	17	16	17	17	17
38399	17.9.33	560	—	,31	,16	2, 20	6, 22	5,	—	—	7	97	16	16	18	17	16	13
38400	11.9.33	593	—	—	,27	13, 29	—	—	—	—	3	33	16	16				
38427	23.9.33	582	—	,28	14, 30	,16	2, 18	4,	—	—	7	99	17	16	16	17	16	16
38430	24.9.33	—	died 5.4.35	—	—	—	—	—	—	—	—	—				—		
38436	24.9.33	571	—	—	,18	3, 20	died 27.5.35	—	—	—	3	(incomplete)	15	17				

Table II.

Group II: Merino Flock Sheep (1933).

38347	2.9.33	525	9,	,30	,17	5,	11, 30	—	—	—	6	142	49	18	18	37	19	
38349	3.9.33	—	—	—	—	—	—	—	—	—	0	—						
38351	1.9.33	—	—	—	—	—	—	—	—	—	0	—						
38361	10.9.33	—	—	—	—	—	—	—	—	—	0	—						
38404	13.9.33	—	—	—	—	—	—	—	—	—	0	—						
38406	11.9.33	620	—	—	—	,24	—	—	—	—	1	1						
38450	25.9.33	—	—	—	—	—	—	—	—	—	0	—						
38469	1.10.33	537	—	,22	8, 25	11, 29	—	—	—	—	5	69	17	17	16	18		
38479	5.10.33	492	9,	—	—	—	—	—	—	—	1	1						
38536	17.10.33	—	—	—	—	—	—	—	—	—	0	—						

Table III.

The Sexual Activity of Young Crossbred and Merino Sheep.

Group.	Average age at 1st oestrus.	Average No. of dioestrous cycles.	Average length of sexual season.	Frequencies of the periodicity of oestrus (days).										Total.
				13	15	16	17	18	19	31	35	37	49	
	days.		days.											
I.....	575·1 (9)	5·2 (9)	74·9 (8)	1	2	16	13	2	—	1	1	—	—	36
II.....	543·5 (4)	3·2 (4)	53·2 (4)	—	—	1	2	3	1	—	—	1	1	9

Note:—The numbers in brackets indicate the number of individuals concerned in the averages.

Discussion.

The growth curves of the four groups of sheep, as illustrated in Diagram 5, indicate an expected higher rate of growth of the Border Leicester-Merino crossbreds (Groups I and III) than that of the Merinos (Groups II and IV).

A decreased rate of growth is evidenced during the period of 3 to 6 months of age. In spite of the supplementary feeding of concentrates to the 1934 lambs, their growth is somewhat less than that of the 1933 lambs, the pasture of which was unsupplemented during that period. It is during December and January that tapeworm infection is most severe and the infection of the 1934 lambs was greater and of longer duration. The adverse effects on growth are most marked up to the age of 12 months. The 1933 and 1934 crossbreds at 6 months of age weighed 57·2 and 54·2 pounds respectively and at 12 months of age only 56·4 and 52·7 pounds respectively. The 1933 and 1934 Merinos at 6 months of age weighed 45·4 and 41·2 pounds respectively and at 12 months of age only 52·0 and 45·4 pounds respectively. Bartel and Johnstone (1934) found that, under Western Province (South Africa) conditions, Border Leicester-Merino crossbreds and Merinos weighed 70·7 and 67·4 pounds respectively at 4·5 months of age. Maré (1930) indicates that Merino (flocks) at the ages of 3 and 6 months, under Karroo (South African) conditions, attain the weights of 46·3 and 59·7 pounds respectively. Colebatch and Scott (1928), under South Australian conditions, found that Border Leicester-Merino crossbreds and Merino lambs reared under farm conditions on natural pasture only, weighed 65·3 and 60·4 pounds respectively at the age of 14 weeks. It is apparent that the weights of the sheep reported upon in this experiment are considerably lower than that of those reported upon by the above authors.

Slight beneficial effects of supplementary feeding are indicated in the results during the period March to June, when the 1933 lambs lost weight while Groups III and IV at least made small gains.

The results of growth and improvement of condition depend greatly upon the time of the arrival of the spring rains. In the case of the 1933 lambs, green grazing was available when the sheep were about 11 months old, but in the case of the 1934 lambs, their first winter was long, dry, and severe, for by the end of September, 1935, no green grazing was available. In cases such as the latter, supplementary feeding, as employed on a large scale in general farm practice, cannot result in a satisfactory rate of growth. It is, therefore, apparent that, in order to obtain a higher rate of growth throughout the first 12 months, a higher level of feeding must be adopted, but it is questionable whether satisfactory results will be obtained unless a more complete check on worm infection is accomplished.

The results of the oestrous observations up to the age of twelve months indicate that, under the conditions to which Groups I to IV were subjected, sexual activity does not occur. Quinlan, Maré, and Roux (1930) found that Merino sheep under Karroo conditions are sexually mature at 9 to 10 months of age. It has been indicated in a

previous report (Experiment 5) that 40 per cent. of Blackhead Persian-Merino crossbreds are sexually mature at the ages of 10 to 12 months.

Diagram 5 further indicates that the 1933 lambs made slow progress during the second year, and the Merinos, Group II, merely maintained their weight over a long period. It was, however, during the ages of 12 to 24 months that sexual activity commenced (Tables I and II of the text).

The crossbreds (1933) show an almost uniform increase in weight from 12 to 24 months of age, and sexual activity commenced at about 18 months and terminated at approximately 21 months of age (Table I). At 19 months of age, 90 per cent. of these sheep had attained sexual maturity and the mean weight at about that age was approximately 75 pounds.

Poor increase in weight is shown by the Merinos (1933) during the 12th to the 24th month of age. Although oestrus was observed at an early date in two individuals, only 40 per cent. of the sheep showed oestrus at from 18 to 20 months of age, and, in half these cases, oestrus occurred only once (Table II). The mean weight of the Merinos at this age was approximately 59 pounds.

It is apparent from Tables I and II of the text, that both types of sheep have a restricted sexual season, which commences at the age of about 18-19 months in February or March and terminates in June or a month later.

In the case of the Border Leicester-Merino crossbreds, the age at the exhibition of the first oestrus ranged from 556 to 599 days, the average age being 575·1 days (Tables I and III). The length of the first sexual season of these sheep varies from 33 to 102 days, the average being 74·9 days. During the sexual season, from 3 to 7 dioestrous cycles are experienced and the average number of cycles is 5·2. The duration of the dioestrous cycle varies from 13 to 35 days with a mode of 16 days, and, in approximately 81 per cent. of cases, oestrus recurs after 16 and 17 days.

The information upon the young Merinos is insufficient to permit a comparison of details, although the corresponding data obtained from some of these sheep, Group II, have been included in Table III. There is an indication that the duration of the dioestrous cycle of Merinos is longer than that of the crossbreds.

B. The Sexual Activity of Young Sheep of Various Breeds and Crosses under Karroo (Cape) Conditions.

Oestrous observations upon sexual activity in young sheep of various breeds and crosses are being made by the Research Section of the Sheep and Wool Division at the "Grootfontein", School of Agriculture, Middelburg, Cape. The experiments are under the direction of Dr. Quinlan, Sub-Director of Veterinary Services, Onderstepoort, Pretoria. By the kind permission of Dr. Quinlan, certain of the results of these experiments are presented here in order to indicate the varying degrees of sexual activity exhibited by certain breeds and types of young sheep under Karroo conditions.

The sheep under observation have been run on the veld which has been supplemented with a lick consisting of the following: Salt 8·4 lb., bonemeal 8·4 lb., tobacco dust 1 lb., and sulphur 1 lb. Oestrous observations are made with vasectomised teasers at the observation yards to which the sheep are brought once daily.

Some of the data kindly supplied to the author have been analysed and presented in Table IV of the text.

It is seen that Merino sheep at 16·5 months of age weigh 66·6 pounds. During the ages of 12 to 17·5 months, 50 per cent. of the sheep show oestrus, and great variation exists in the number of dioestrous cycles experienced; the maximum number of cycles experienced is 7. The sheep that exhibit oestrus go into anoestrum during June and July. The mean duration of the inactive period is 140·5 days.

Blackhead Persian sheep at 16·5 months of age weigh 67·8 pounds. All sheep are sexually active during the ages of 12 to 17·5 months and 9 to 11 dioestrous cycles are experienced by these sheep, the average being 9·8 cycles during a period of 169 days. Forty per cent. of the sheep did not show oestrus upon the expected dates during the earlier part of September, which suggests that these sheep might have gone into anoestrum. The mean duration of the inactive period is only 13·1 days.

The Southdown-Blackhead Persian crossbreds weigh only slightly more, 2·7 pounds, at 16·5 months of age than do the Blackhead Persian sheep. All the former sheep are sexually active during the ages of 12 to 17·5 months, but the mean number of dioestrous cycles experienced by the crossbreds is 7·3, or 2·5 less than that of the Blackhead Persian sheep. All the sheep go into anoestrum during July and August. The mean duration of the inactive period is 56·9 days.

The data upon the purebred Ronderibs have not been included as the number is small (6) and the dates of birth vary considerably beyond the usual period of lambing of six weeks. However, it appears that certain individuals of this breed reach sexual maturity at 6·5 months of age and that the age of puberty depends greatly upon the time of birth.

The Welsh Mountain-Ronderib sheep were approximately 7·5 months old when observations were commenced. They experienced an average of five dioestrous cycles during the ages of 7·5 to 12 months. It appears from the oestrous observation records that the first exhibitions of oestrus recorded for all these crossbreds were the first occurences of oestrus of these sheep and, therefore, such crossbreds become sexually mature at approximately 7·5 months of age. The sexual activity of these sheep ceases in June and July and the mean duration of the inactive period is 101·1 days. Such crossbreds grow rapidly; they attain 67·1 pounds at the age of 11 months.

TABLE IV.

The Sexual Activity of Various Breeds and Crosses of Sheep under Karroo Conditions.

Breed or type.	No. of sheep under observation.	Duration of observation period: Apr. 1st. to Sept. 16th, 1935.	Average age at commencement of observations.	Mean weight.	Maximum number of sexually active sheep.	Number of dioestrous cycles.												Mean duration of inactive period.*
						Total.	Frequencies.											
							0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	
		(Days.)	(Months.)	(lb.)														(Days.)
Merino.....	10	169	11·5	66·6 at 16·5 months	5	20	5	1	1	1	—	1	—	1	—	—	—	—	140·5
Blackhead Persian....	10	169	11·5	67·8 at 16·5 months	10	98	—	—	—	—	—	—	—	—	—	5	2	3	13·1
Southdown-Blackhead Persian	10	169	11·5	70·5 at 16·5 months	10	73	—	—	—	—	—	—	3	3	2	2	—	—	56·9
Welsh Mountain-Ronderib	10	169	7·5	67·1 at 11·0 months	10	50	—	—	—	1	2	4	2	1	—	—	—	—	101·1

* NOTE.—In the case of the mean duration of the inactive period, cases in which inactivity existed between the time of the commencement of observations and the onset of oestrus, this period of inactivity has been added to the period of inactivity prior to the date up to which the observations have been considered, that is up to September 16th, 1935.

Conclusions.

1. Observations were made to ascertain the age of sexual maturity of Border Leicester-Merino crossbreds and Merino flock sheep under eastern Transvaal conditions of management.

2. Continuous growth is inhibited in crossbreds and Merinos during the first 12 months. Worm infection is largely responsible for the inhibition of the progress of growth during the ages of 3 to 6 months. A higher level of feeding than that generally practised during the winter months is essential in order to promote continuous growth.

3. Border Leicester-Merino crossbreds at the age of 19 months weigh approximately 75 pounds; at this age 90 per cent. attain sexual maturity and experience a number of normal dioestrous cycles.

4. Merino flock sheep at the age of 19 months weigh approximately 59 pounds; at this age 40 per cent. attain sexual maturity, but a number of normal dioestrous cycles is experienced in only 20 per cent. of cases.

5. Border Leicester-Merino crossbreds and Merino flock sheep at the ages of from 17 to 21 months, experience a restricted sexual season of about 50 to 75 days duration.

6. Border Leicester-Merino crossbreds attain satisfactory size to permit breeding at 19 months of age, and the regular occurrence of oestrus permits mating these sheep at that age.

Spring born Merino sheep are small and immature at the age of 19 months under eastern Transvaal farm conditions and mating at that age is not recommended.

7. The sexual activity of young sheep of the following breeds and crosses under Karroo conditions has been analysed: Merino, Blackhead Persian, Southdown-Blackhead Persian, Ronderib, and Welsh Mountain-Ronderib.

(*a*) All the breeds and crosses exhibit sexual activity during the months of April to September, but, in certain of these types, sexual activity is not extended throughout the entire period.

(*b*) The lowest sexual activity is reflected by Merinos 12 to 17·5 months old; 50 per cent. of the sheep are sexually active and the active sheep go into anoestrum during June and July.

(*c*) The highest degree of sexual activity is experienced by the Blackhead Persian sheep, 100 per cent. of which are sexually active and experience regular dioestrous cycles during the ages of 12 to 17·5 months.

(*d*) Although a high degree of sexual activity is experienced by Southdown-Blackhead Persian crossbreds between the ages of 12 to 17·5 months, these sheep go into anoestrum during July and August. The reduced period of activity is considered to be due to the genetic influence of the Southdown.

(*e*) Ronderib lambs become sexually active at approximately 6 months of age; the majority of young sheep go into anoestrum during May to August.

(*f*) Welsh Mountain-Ronderib crossbreds become sexually active at approximately 6 months of age, but these sheep go into anoestrum during June and July.

8. Merino sheep are better grown and at least 50 per cent. experience sexual activity at an earlier age under Karroo veld conditions than under eastern Transvaal conditions.

EXPERIMENT 6.

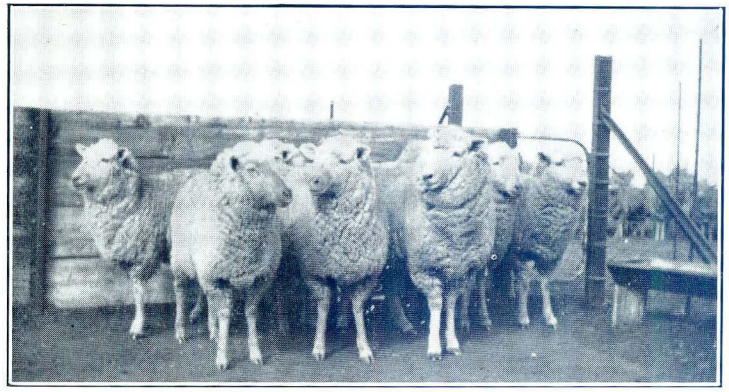


Fig. 24.—Group I: 23.7.35.

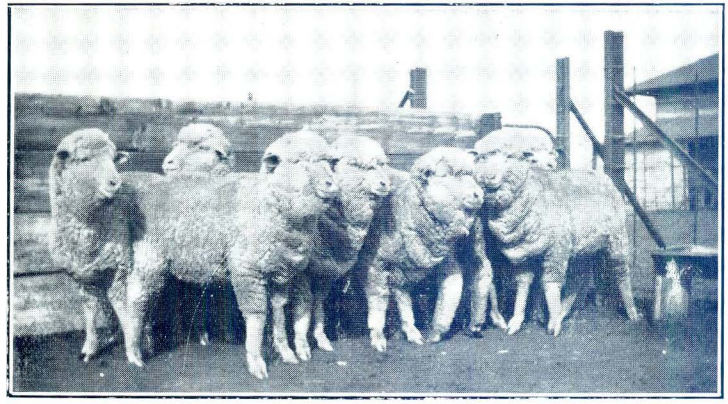


Fig. 25.—Group II: 23.7.35.

EXPERIMENT 6.

Fig. 26.—Group III : 23.7.35.

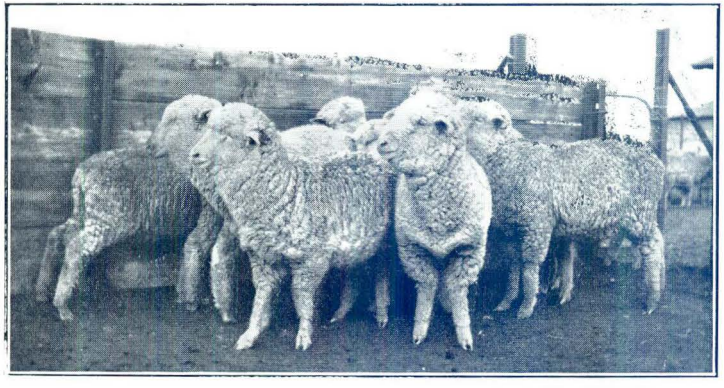


Fig. 27.—Group IV : 23.7.35.

EXPERIMENT 7.

The Influence of Climate upon the Sexual Activity of Young Merino Ewes.

Farmers in the Transvaal frequently purchase sheep from Karroo breeders. The reactions of sheep to altered conditions of climate are of practical interest; it is suspected that upon transfer temporary sexual inactivity results. Quinlan and Maré (1931) consider that such inactivity is experienced when sheep are transferred from the humid coastal districts to the arid climate of the Karroo. Merino sheep under Karroo conditions exhibit continuous annual sexual activity (Quinlan and Maré, 1931), but it has been indicated by the results of preceding experiments reported in this thesis that such activity is restricted under the conditions obtaining at the Research Station, Ermelo. It has not been determined whether these differences in the degree of polyoestrum are due to climatic, nutritional, or other factors.

The physiographical conditions of the Karroo differ from those of the eastern Transvaal highveld. The former conditions are considered to be infinitely more favourable for sheep farming than those of the latter area. The greatest advantage of the Karroo is generally accepted to be the comparatively higher nutritive value of the natural pasture, which, in addition, is not subject to drastic reductions in nutritive value during the dry winter months. In Karroo areas, sheep experience marked loss of weight only during prolonged droughts. With respect to climate, the Karroo and eastern Transvaal highveld are both summer rainfall areas, but the former is semi-arid while the annual rainfall of the latter approximates 30 inches; extreme temperatures are experienced in both areas. The following Table I gives certain meteorological data recorded at the Grootfontein School of Agriculture, Middelburg, Cape, and this data may be compared with the corresponding data recorded at the Government Forest Nursery which adjoins the Research Station, Ermelo (Introduction, Table I).

Table I.

Meteorological Records: Grootfontein, School of Agriculture, Middelburg, C.P.

Month 1935.	Total Rainfall.	Highest Maximum.	Lowest Maximum.	H. (Screen) Minimum.	L. (Screen) Minimum.
January.....	1·15	94·8	72·9	63·2	39·5
February.....	2·83	90·8	62·4	65·0	37·3
March.....	2·30	88·5	62·1	60·8	35·2
April.....	1·73	80·6	56·8	55·3	29·6
May.....	2·66	68·7	44·4	55·0	25·8
June.....	0·99	66·0	41·5	44·7	22·5
July.....	0·53	68·0	35·0	43·0	19·1
August.....	0·26	74·5	39·6	40·7	16·0
September.....	0·76	83·8	53·2	46·0	27·0
October.....	0·34	91·3	64·4	64·9	28·7

The objects of this experiment were to determine the reaction, with respect to sexual activity, of young Merino ewes which are transferred from the Karroo to the eastern Transvaal, and to ascertain whether any reaction that may result is due to altered climatic conditions or to nutritional factors.

(NOTE: The experiment has been planned to permit the extension of the observations in order to determine the following:—

1. The influence of climate upon the rhythm of the sexual cycle when sheep are:
   - (i) Mated in the spring to lamb in the autumn under:
     - (*a*) Eastern Transvaal conditions.
     - (*b*) Karroo conditions.
   - (ii) Mated in the autumn to lamb in the spring under:
     - (*a*) Eastern Transvaal conditions.
     - (*b*) Karroo conditions.
   - (iii) Not mated under:
     - (*a*) Eastern Transvaal conditions.
     - (*b*) Karroo conditions.
2. The influence of climatic and nutritional factors when such sheep are not mated under:
   - (*a*) Eastern Transvaal conditions.
   - (*b*) Karroo conditions.

It will be noticed that the experiment has been commenced comparatively recently, March, 1935; consequently, the results of this latter phase of the experiment are not available for the present report, but they will appear in a later issue of the Onderstepoort Journal).

Materials and Methods.—Eighty Merino ewes, bred from the large flock maintained by the "Grootfontein," School of Agriculture, Middelburg, Cape, were drafted into the experiment in March, 1935, when the sheep were approximately 10·5 months of age. Forty of the sheep were transferred to the Research Station, Ermelo, where they arrived on 16.3.35. Oestrous observations were commenced the following day and after four days, the sheep were divided into four groups. The remaining 40 sheep were retained at the "Grootfontein," School of Agriculture. Due to a delay, the oestrous observations at the latter Institution were commenced about 14 days later than those at Ermelo.

Observations at each of the two centres were conducted on four groups each consisting of 10 sheep. Oestrous observations upon 10 of the sheep included in the number at the "Grootfontein School of Agriculture" (Group V) were conducted in connection with studies on sex physiology of sheep under the direction of Dr. Quinlan, Sub-Director of Veterinary Services, Onderstepoort, Pretoria. Dr. Quinlan has kindly consented that the results obtained from this veld group, be used for comparative purposes in this experiment.

The eight groups were given the following treatments:—

A. *Ermelo:*

Group I: On veld supplemented by a lick; supplementary feeding during the winter months.

Group II: Dry-lot: Maize 6 oz., lucerne hay 1·5-2 lb. and a lick.

Group III: Similar to that of Group II.

Group IV: Similar to that of Group II.

B. *Grootfontein:*

Group V: On veld supplemented by a lick.

Group VI: Similar to that of Group II.

Group VII: Similar to that of Group II.

Group VIII: Similar to that of Group II.

(NOTE.—The veld sheep, Groups I and V will not be bred. Another of the remaining groups at each of the centres will not be bred. A group at each of the centres will be bred from November 15th, 1935, to produce autumn lambs, while the remaining group at each centre will be bred from April 15th, 1936, to produce spring lambs. Continued observations upon the sexual activity should reveal any differences at the two centres that may be reflected by sheep which are not bred and those that are bred at different seasons of the year.)

The rations of Groups II to IV and VI to VIII were similar. In both sections A and B, yellow maize, lucerne hay, and a lick consisting of 3 parts bonemeal and 1 part of salt (by weight), were fed. Unfortunately, it has not been possible to utilize feeds from the same source of supply; however, the maize used at both centres was Transvaal or Free State grown and the lucerne was Karroo grown.

The above dry-lot fed groups were kept in small yards devoid of grazing and in which all rations were fed. It has been reported that, unfortunately, the quality of the lucerne hay fed to Groups VI, VII, and VIII at "Grootfontein" was not uniformly of good quality; reference to this point will be made in the subsequent discussions.

The daily oestrous observations at both centres were conducted between 7 and 8 a.m., vasectomised teasers being used. At the close of the sexual season, 1935, oestrous observations at the Research Station, Ermelo, were made twice daily for three months in order to ascertain whether cases of oestrous periods of abnormally short duration occurred in young Merino ewes. No such cases were revealed.

The sheep at the Research Station, Ermelo, were weighed at 14 day intervals, while those at the "Grootfontein", School of Agriculture, were weighed at 28 day intervals. It will be noticed that the commencement of recording weight data of the veld group at the latter Institution was delayed. All sheep were starved for 12 to 14 hours before being weighed.

The sheep were dosed with Government Wireworm Remedy at 28-day intervals. Inoculation against bluetongue and the annual shearing took place at approximately the same date at the two institutions.

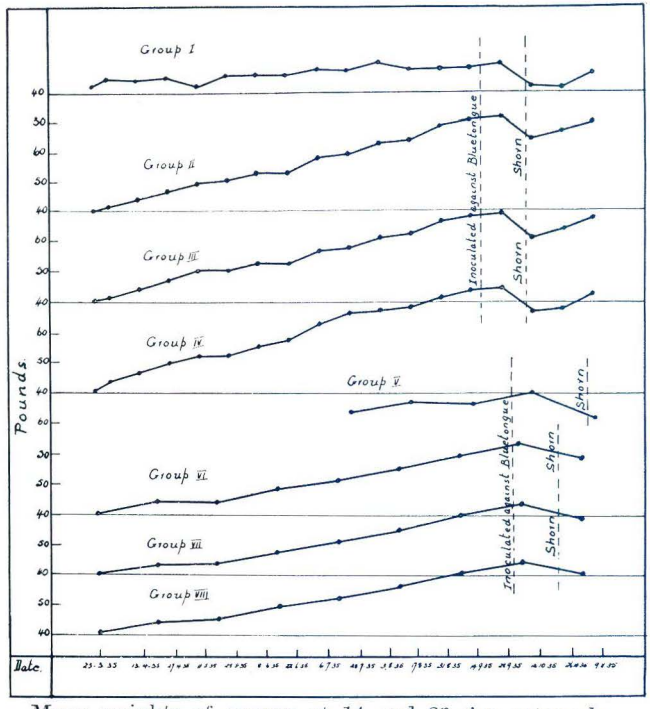
In the case of Group I at the Research Station, Ermelo, it was intended to supplement the winter grazing with green oat grazing by permitting the latter for 1 to 2 hours daily. Due to the prolonged absence of rain and the severity of the winter, green cereal grazing could not be supplied throughout the winter months and supplementary feeding of maize had to be undertaken. The total period during which supplementary green oat grazing was allowed was approximately three months, while the period during which 4 to 6 ounces of maize were fed was approximately two months.

As the veld groups at both centres were run together with other experimental sheep, the lick consumption of the sheep in this experiment was taken as the average of the entire flock.

Results.

The weight data of Groups I to VIII are given in Appendix 6, Tables I to VIII; the mean weights at each interval have been computed and from these Diagram 6 has been constructed.

DIAGRAM 6.
EXPERIMENT 7.



Mean weights of groups at 14 and 28 day intervals.

An analysis of the mean weights of the groups and the shearing data are presented in Table II.

TABLE II.

Mean Weight and Shearing Data.

Group.	Mean initial weight.		Mean weight prior to shearing.		Percentage gain per 100 days on mean initial weight.	Shearing data. Grease wool yields. Range.	Shearing data. Grease wool yields. Average.	Mean weight immediately after shearing.	
	lb.	Date.	lb.	Date.	Per cent.	lb.	lb.	lb.	Date.
I.....	42·0	23.3.35	46·8	28.9.35	6·0	5·8– 7·2	6·3	39·6	12.10.35
II.....	41·5	,,	69·0	,,	34·9	6·9– 9·7	8·8	61·4	,,
III.....	41·8	,,	67·8	,,	32·9	6·4– 9·8	8·4	60·0	,,
IV.....	41·9	,,	73·3	,,	39·6	7·9–11·0	8·9	65·6	,,
V.....	(41·5)*	(25.3.35)	69·0	23.10.35	31·1	7·4–10·2	8·6	60·1	7.11.35
VI.....	41·2	25.3.35	61·6	7.10.35	25·1	5·5–10·3	7·9	56·8	4.11.35
VII.....	41·2	,,	62·1	,,	25·7	6·3– 9·8	7·9	56·8	,,
VIII.....	41·2	,,	63·3	,,	27·2	6·4–10·6	8·2	58·8	,,

* NOTE.—In the case of Group V no initial weight was recorded. The mean weight given has been computed from the mean initial weights of all other groups.

TABLE III.

A Summary of Sexual Activity.

Group.	Period of oestrous observations.		No. of sexually active sheep.	No. of dioestrous cycles.								Months during which sexual activity occurred.
				Frequencies.							Total.	
				0.	1.	2.	3.	4.	5.	6.	7.	
	Date.	Days.										
I.....	17.3.35–15.11.35	244	0	10	—	—	—	—	—	—	—	0	No activity.
II.....	,, ,,	,,	2	8	1	—	1	—	—	—	—	4	May, June, October.
III.....	,, ,,	,,	2	8	2	—	—	—	—	—	—	2	May, October.
IV.....	,, ,,	,,	3	7	2	1	—	—	—	—	—	4	May, June.
V.....	1.4.35–15.11.35	229	5	5	1	—	1	1	1	—	1	20	April, May, June, July.
VI.....	8.4.34– ,,	222	2	8	1	—	—	1	—	—	—	5	June, July, August.
VII.....	,, ,,	,,	4	6	—	2	1	—	1	—	—	12	April, May, June, July.
VIII.....	,, ,,	,,	2	8	—	1	1	—	—	—	—	5	May, June, July.

The details of the results of the oestrous observations on Groups I to VIII are given in Appendix 6, Tables IX to XVI.

A summary of the sexual activity of the groups is given in Table III of the text.

The feed and lick consumption of the eight groups of sheep are given in Table IV of the text.

TABLE IV.

Feed and Lick Consumption.—Average per Sheep per Day.

Group.	Maize.	Lucerne hay.	Lick (bone meal and salt.
	oz.	oz.	oz.
I.....	Control	On pasture	·537
II.....	6·0	30·4	·026
III.....	6·0	30·4	·026
IV.....	6·0	30·4	·026
V.....	Control	On pasture	·210
VI.....	4·5	23·6	·017
VII.....	4·4	24·7	·018
VIII.....	3·7	24·8	·017

Photographs of each of the eight groups of sheep are given in Figs. 28 to 35.

Discussion.

Quinlan, Maré, and Roux (1930) reported that Merino ewes transferred from the Karroo (Middelburg, Cape) to the Onderstepoort Laboratory, Pretoria, Transvaal, at the age of 6 to 8 months, all showed oestrus during the month of January (1928) when they were 9 to 10 months old. It is stated that " . . . this is generally what is expected under South African conditions; lambs born in the autumn and early winter, show oestrus the following summer at the age of 9 to 10 months if maintained in good condition ". Quinlan and Maré (1931) reported that, under favourable Karroo conditions, non-pregnant and non-lactating ewes experience a continuous series of dioestrous cycles throughout the year.

It was considered that the sheep chosen for this experiment, being approximately 10·5 months of age, would be sexually mature and that they would, under Karroo conditions, be exhibiting normal ovarian activity. However, the detailed results of the oestrous observations indicate that in only 3 out of 80 cases did oestrus occur within 20 days after the commencement of the observations; all 3 of the cases of sheep which exhibited an early oestrus were individuals which had not been transferred to Ermelo. (Appendix 6, Tables IX to XVI.) Further, it is seen from these tables that 75 per cent. of the ewes revealed no sexual activity during the period of observations of about 8 months, or when the sheep were between the ages of 10·5 and 18·5 months.

Diagram 6 illustrates the weight tendencies of the eight groups of sheep. With the exception of Group I, the veld group at Ermelo, the groups showed almost constant increases in weight and the mean weights of these groups just prior to and immediately after shearing compare very favourably with those of a similar type of sheep reported upon by Quinlan, Maré, and Roux (1930). It is seen that, in spite of Group I being given what was considered good farm management, this group maintained a mean weight at approximately the 45 lb. level. As Groups II to VIII attained weights just prior to shearing ranging between 62 and 73 lb., the weight of Group I must be considered as unsatisfactory.

The extent of gain accomplished by each of the groups and other data relative to body weight and wool production, are given in Table II. Further evidence of the unsatisfactory reaction of Group I is revealed, as the percentage gain on the initial weight up to just prior to shearing is only 6·0 per cent. per 100 days, whereas that of all other groups exceeds 25 per cent. The mean weight of Group I immediately after shearing is only 39·6 lb., whereas that of other groups approximates 60 lb. The average grease wool yield of the former is 6·3 lb., which is significantly less than that of the latter groups, although it may be said that, considering the apparent inhibition of body growth of Group I, the wool yields are surprisingly high.

The dry-lot fed sheep at Ermelo, Groups II, III, and IV, are seen to have made higher gains than the corresponding sheep, Groups VI, VII, and VIII, at " Grootfontein " (Table II). The percentage gains per 100 days up to the time of shearing of the Ermelo sheep are 34·9, 32·9, and 39·6, whereas the corresponding gains of the Grootfontein sheep are 25·1, 25·7 and 27·2 per cent. The mean weights of the three dry-lot fed groups after shearing are somewhat higher at the former centre, and the same remark may be applied to the wool yields. This difference is suspected to be due to the smaller amounts of feeds consumed by the three groups at " Grootfontein " (Table IV). Previous mention was made of the difference in quality of lucerne hay fed to the sheep at " Grootfontein "; this appears to be the main factor involved.

The dry-lot fed groups at Ermelo compare very favourably with the veld group at Grootfontein with respect to weight and wool production; in the latter the mean wool yield is 8·6 lb. and the mean body weight after shearing is 60·1 lb.

It is seen from Table III that the group on veld at Ermelo is the only group in which no sexual activity was experienced. On the other hand, the veld Group V, under Karroo conditions, showed greatest sexual activity; 50 per cent of the sheep exhibited oestrus, one sheep experienced as many as 7 dioestrous cycles, and the total number of cycles of the group is seen to be 20; sexual activity occurred during the months of April to Jul.y

As the three groups of dry-lot fed sheep at each of the two centres received identical treatment during the period under consideration, for the present the sexual activity of the 30 sheep at

Ermelo may be compared with that of the 30 sheep at "Grootfontein". At the former centre, 7 sheep showed oestrus, at the latter 8 sheep, but the total number of dioestrous cycles experienced by these sheep is seen to be 10 and 22 respectively (Table III). At Ermelo, the majority of active sheep experienced only one dioestrous cycle, the maximum number of cycles being 3; at "Grootfontein," the majority of active sheep experienced 2 and 3 dioestrous cycles, the maximum number of cycles being 5. It should be pointed out that one sheep in each of Groups II and III exhibited oestrus during October; no previous activity had been observed in these sheep, and no instances of activity during September, October, and November were observed at "Grootfontein". (Appendix 6, Tables IX to XVI.) Apart from these two instances of activity at Ermelo, the remaining limited activity appears to have been restricted to May and June, while at "Grootfontein" sexual activity occurred in all the months from April to August.

With the exception of two cases in Group V and one case in Group VII, the onset of sexual activity may be considered to have commenced after oestrous observations had begun. It appears, therefore, that these sheep experienced a restricted season of sexual activity (Appendix 6, Tables IX to XVI).

By consulting the details of the oestrous observations and the individual weight data (Appendix 6, Tables I to XVI), it will be found that most of the sheep at both centres which experienced sexual activity are below the average weight of their respective groups and, in fact, in many cases they are some of the lightest sheep.

Conclusions.

1. Observations were made to determine the effects of transferring 40 autumn-born Merino ewes at the age of 10·5 months from the Karroo to the eastern Transvaal.

The observations are reported up to the time when the sheep were 18·5 months of age.

It is indicated that the plan of the experiment eventually aims to ascertain the influence of the absence of breeding and the time or season of breeding upon ovarian activity and the rhythm of the sexual seasons.

2. Merino ewes under Karroo veld conditions up to the age of 18·5 months, attain a weight of 60·1 lb. off shears, and they yield an average grease wool weight of 8·6 lb. Fifty per cent. of such sheep are sexually active when from 12 to 13½ months old. Sexual activity is restricted to the months of April to July, during which period 7 dioestrous cycles may be experienced, From July up to at least the middle of November, such sheep are in anoestrum.

3. Merino ewes reared under Karroo veld conditions up to the age of 10·5 months and then transferred to eastern Transvaal farm conditions, suffer great inhibition of body growth. They maintain an almost constant weight for 7 months and weigh 39·6 lb. off-shears at the age of 18·5 months. The grease wool production of such sheep is 6·3 lb.

No sexual activity is experienced by such sheep up to the age of 18·5 months.

Nutritional factors are responsible for these adverse effects.

4. Very satisfactory body growth and wool production result when Merino ewes 10·5 to 18·5 months of age are fed a daily ration of 4 to 6 ounces of maize, 1·5 to 2·0 lb. of lucerne hay and a lick of bone meal and salt. Average off-shear weights of 56·8 to 65·6 lb. are attained at the age of 18·5 months, and the grease wool yields of such sheep range from 7·9 to 8·9 lb. Twenty-three to twenty-seven per cent. of such sheep are sexually active when from 12 to 17 months old, but in the majority of cases only 1, 2, and 3 dioestrous cycles are experienced, the greatest activity occurring during May, June, and July. While a few cases of a single oestrus may occur after July, the majority of the sheep are in anoestrum for at least 2·5 months.

An alteration of climate appears to have some effect upon the duration of the sexual season; a change from the Karroo to the eastern Transvaal reduces the number of dioestrous cycles experienced by approximately 54 per cent.

EXPERIMENT 7.

Fig. 28.—Group 1: 23.7.35.

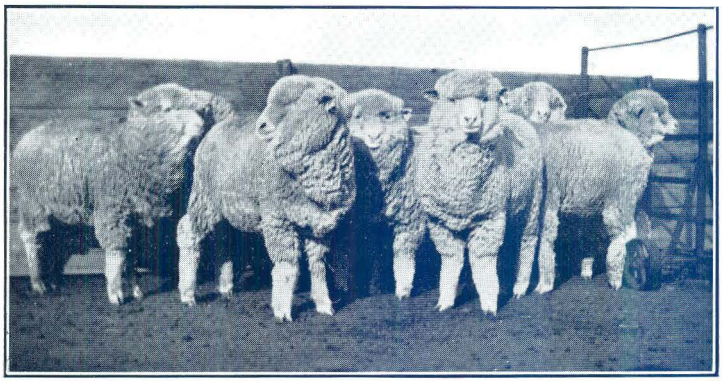


Fig. 29.—Group II: 23.7.35.

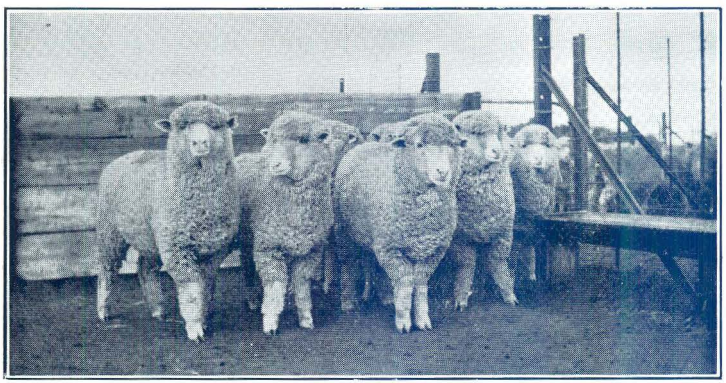


Fig. 30.—Group III: 23.7.35.

EXPERIMENT 7.

Fig. 31.—Group IV: 23.7.35.

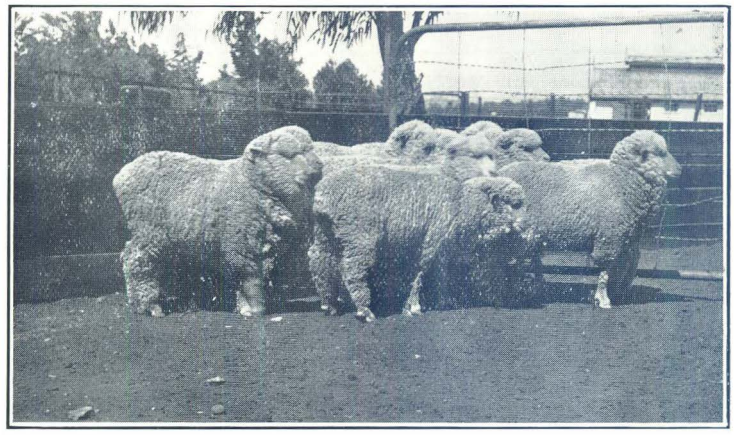


Fig. 32.—Group V: 23.7.35.

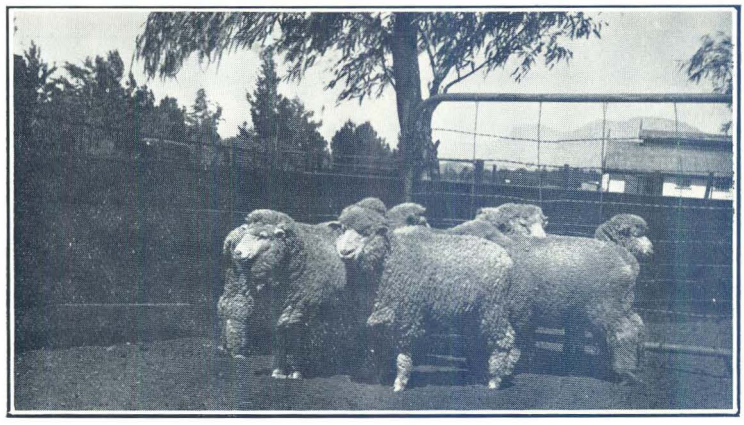


Fig. 33.—Group VI: 23.7.35.

EXPERIMENT 7.

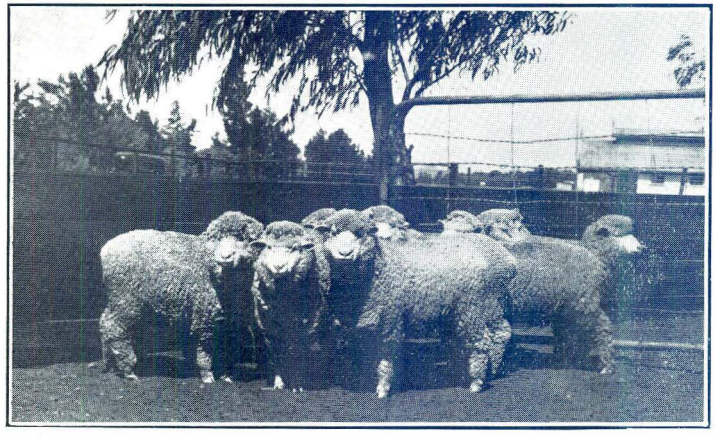


Fig. 34.—Group VII: 23.7.35.

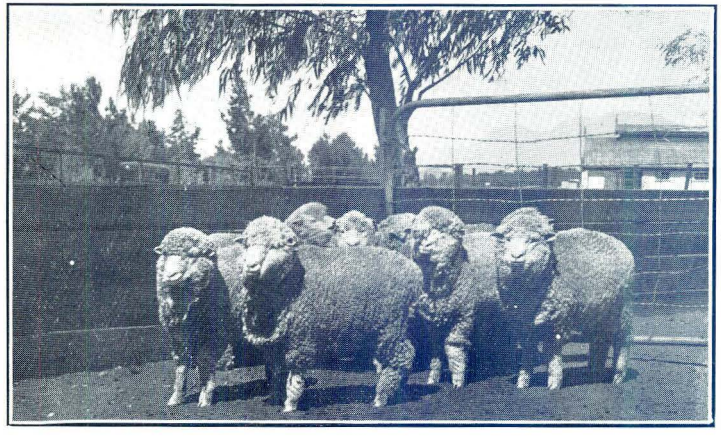


Fig. 35.—Group VIII: 23.7.35.

EXPERIMENT 8.

The Effects of Inoculation, Shearing, and Dipping upon Sexual Activity.

In most areas in South Africa, inoculation against bluetongue and dipping against external parasites are essential practices. Generally, inoculation is done about three weeks before shearing, which is followed by dipping. The usual custom is to complete these farm operations before the mating season which, when autumn lambs are obtained, falls during October, November, and December, or even until as late as January. Variations of the order of inoculation, shearing, dipping, and mating do occur, for, in some areas, shearing is undertaken later and even as late as February. It is not necessary here to enter into the pros and cons of the best procedure for any particular area. It is evident that less difficulty in regulating the practices must be experienced when mating is done during the autumn than when spring mating is undertaken.

Frequently, suspicion exists that inoculation, shearing, and dipping affect the sexual activity of ewes in that either the onset of the sexual season is delayed, or the continuity of the dioestrous cycles is interrupted. Apart from making observations to prove or disprove these beliefs, it appeared that any information relative to this aspect would serve to render the findings in all other experiments reported here more complete.

The object of the experiment was to ascertain whether the oestrous cycle in the ewe is affected in any way by inoculation, shearing, and dipping.

Materials and Methods.—Six groups of sheep, each consisting of 10 well-grown mature Merino ewes, were drafted into the experiment on October 13th, 1933. These sheep had been inoculated against bluetongue, shorn, and dipped a year previous to their inclusion in the experiment. It is not known whether all the sheep were bred the previous season.

The sixty sheep were grazed in one flock on natural pasture and they were given a constant supply of a lick consisting of two parts of bone meal and one part of salt. Dosing for gastric and intestinal worms was carried out at 28-day intervals.

The flock was brought to the observations yards once daily for oestrous observations for which vasectomised teasers were used; the sheep were tested in groups of 10-15.

The sheep were weighed at 14-day intervals; they were starved for 12 to 14 hours before being weighed.

The treatments of the groups are given in Table I.

TABLE I.

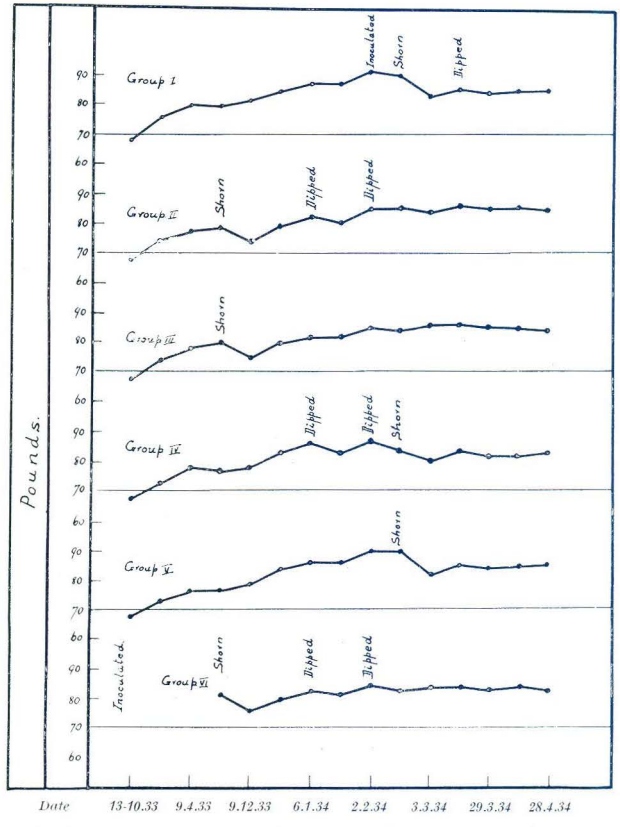
Group.	Inoculation.	Shearing.	Dipping.
I.....	February.....	February.....	March.
II.....	No	November.....	January and February.
III.....	No	November.....	No.
IV.....	No	February.....	January and February.
V.....	No	February.....	No.
VI.....	October.....	November.....	January and February.

Results.

The weight data of Groups I to VI are given in Appendix 7, Tables I to VI; the average weights at each period of 14 days have been computed and from these the accompanying Diagram 7 has been constructed.

DIAGRAM 7.

EXPERIMENT 8.



Mean weights of groups at 14 day intervals.

The results of the oestrous observations during the experimental period of 200 days are given in Appendix 7, Tables VII to XII, in which the various treatments to which the groups were subjected have been included; the interoestrous periods of individual sheep are given in these tables.

Tables II and III of the text have been constructed from Tables VII to XII of Appendix 7 in order to present the main features of sexual activity of each group. In Table II the total period has been divided into six periods, the time of application of the treatments forming a basis for such divisions.

It will be noticed that one sheep in Group I, two sheep in Group II, and two sheep in Group III, did not exhibit oestrus during the experimental period. Three sheep in Groups I and II showed oestrus after an extension of the period of testing; in these cases the inactive period is given in brackets (Appendix 7, Tables VII and VIII). The two inactive sheep in Group III were slaughtered for the examination of their ovaries after inactive periods of 307 and 253 days. The results of the examinations of the ovaries of these sheep are given in Appendix 7A and Table IV of the text presents a summary of the findings.

Discussion.

Generally, it is not considered that sheep experience a marked setback in condition from the annual operations of inoculation against bluetongue, shearing, and dipping, but in farm practice these operations are arranged not to take place shortly before or during the mating period as it is suspected that the coming on of heat of ewes is disturbed or inhibited by such treatments.

As shearing generally takes place after the first spring rains and when fresh pasture is available, it may be expected that sheep shorn in the spring or early summer show a sudden increase in weight. It is seen from Diagram 6 that Groups II, III, and VI regained their pre-shearing weights in from 2 to 3 weeks after shearing. However, when shearing is postponed for approximately 3 months, as in Groups I, IV, and V, rapid increases in weight are also experienced during the spring and summer months. It is apparent that, when shearing takes place at the end of summer, no rapid regain of weight takes place. At the end of the experimental period, there is no significant difference between the mean weights of all groups.

When sheep are inoculated against bluetongue annually, the reaction is mild and symptoms of the fever may be seen in only a very small percentage during the 7th to the 15th day after inoculation. An insignificant temporary drop in weight after inoculation is seen in the case of Group I (Diagram 7).

The effect of dipping upon weight is insignificant and this is the case even with sheep in long wool as in Group IV (Diagram 7).

TABLE II.

A Summary of Sexual Activity.

Periods.	13.10.33—26.11.33. (45 days.)			27.11.33—11.1.34. (46 days.)			12.1.34—1.2.34. (21 days.)			2.2.34—25.2.34. (24 days.)		
Group.	Treatment.	No. of dioestrous cycles.	Classes of duration of interoestrous periods.	Treatment.	No. of dioestrous cycles.	Classes of duration of interoestrous periods.	Treatment.	No. of dioestrous cycles.	Classes of duration of interoestrous periods.	Treatment.	No. of dioestrous cycles.	Classes of duration of interoestrous periods.
I (10).....	No.	0	0	No.	9 (6)	15, 16, 17	No.	9 (7)	16, 17, 20	Inoculated 5.2.34	9 (7)	17. 18
II (10).....	No.	0	0	Shorn 27.11.33	3(3)	17	Dipped 12.1.34	3 (3)	17	Dipped 2.2.34	10 (6)	17
III (10).....	No.	0	0	Shorn 27.11.33	8 (5)	17, 18, 19, 20	No.	8 (6)	17, 18	No.	10 (7)	17, 18
IV (10).....	No.	3 (1)	17, 18	No.	5 (4)	16, 17, 18, 19	Dipped 12.1.34	7 (6)	16, 17, 18	Dipped 2.2.34	10 (8)	16, 17, 18
V (10).....	No.	4 (2)	15, 16	No.	12 (5)	16, 17, 18	No.	7 (7)	16, 17, 18, 19, 34, 37	No.	8 (6)	16, 17, 18, 19
VI (10).....	No.	0	0	Inoculated 24.10.33 Shorn 27.11.33	7 (5)	17, 19	Dipped 12.1.34	5 (5)	17, 19, 26	Dipped 2.2.34	9 (8)	17, 18, 34, 39

NOTE :—

(*a*) In the second column of each period the numbers in brackets indicate the number of individuals involved.

(*b*) In the third column of each period classes of duration of the interoestrous period are given.

TABLE II.

A Summary of Sexual Activity.

1.2.34. ys.)	2.2.34—25.2.34. (24 days.)			26.2.34—16.3.34. (19 days.)			17.3.34—30.4.34. (45 days.)			Total number of dioestrous cycles.
Classes of duration of interoestrous periods.	Treatment.	No. of dioestrous cycles.	Classes of duration of interoestrous periods.	Treatment.	No. of dioestrous cycles.	Classes of duration of interoestrous periods.	Treatment.	No. of dioestrous cycles.	Classes of duration of interoestrous periods.	13.10.33—30.4.34 (200 days).
16, 17, 20	Inoculated 5.2.34	9 (7)	17. 18	Shorn 26.2.34	10 (8)	16, 17, 18, 19	Dipped 17.3.34	22 (9)	16, 17, 18, 19	59 (9)
17	Dipped 2.2.34	10 (6)	17	No.	9 (8)	15, 16, 17, 18	No.	11 (7)	16, 17, 18, 33, 34, 36 51, 69	36 (8)
17, 18	No.	10 (7)	17, 18	No.	7 (7)	16, 17, 18	No.	20 (8)	16, 17, 18, 19, 34, 35	53 (8)
16, 17, 18	Dipped 2.2.34	10 (8)	16, 17, 18	Shorn 26.2.34	8 (7)	16, 17, 18, 33, 35, 54	No.	21 (10)	16, 17, 18, 19	54 (10)
16, 17, 18, 19, 34, 37	No.	8 (6)	16, 17, 18, 19	Shorn 26.2.34	9 (8)	16, 17, 18, 19	No.	20 (10)	17, 18, 20, 40	60 (10)
17, 19, 26	Dipped 2.2.34	9 (8)	17, 18, 34, 39	No.	7 (6)	16, 17, 18	No.	20 (10)	17, 18, 32, 36, 41	48 (10)

the numbers in brackets indicate the number of individuals involved.
lasses of duration of the interoestrous period are given.

Table III.

The Inactive Period and Periodicity of Oestrus.

Group.	Period of testing for oestrus. (days)	Duration of inactive period (days)*		Periodicity of oestrus (days).																			
		Range.	Average	15	16	17	18	19	20	26	31	32	33	34	35	36	37	39	40	41	51	54	69	Total.
I.....	200	49–168 (±)	97·6	1	9	25	11	3	1	—	—	—	—	—	—	—	—	—	—	—	—	—	50
II.....	200	83–150 (±±)	109·6	1	8	12	2	—	—	—	—	—	1	1	—	1	—	—	—	—	1	—	1	28
III.....	200	50–151 (±±)	92·8	—	7	19	13	3	1	—	—	—	—	1	1	—	—	—	—	—	—	—	—	45
IV.....	200	0–172	106·9	—	6	22	10	2	—	—	—	—	1	—	2	—	—	—	—	—	—	1	—	44
V.....	200	0–190	91·5	1	8	19	11	6	1	—	1	—	—	1	—	—	1	—	1	—	—	—	—	50
VI.....	200	70–161	108·2	—	2	19	8	2	—	1	—	1	—	1	—	2	—	1	—	1	—	—	—	38
Total...	—	—	—	3	40	116	55	16	3	1	1	1	2	4	3	3	1	1	1	1	1	1	1	255

*Note :—One sheep in Group I and 2 sheep in Groups II and III did not show oestrus during the experimental period ; these cases have been omitted in the computations of the duration of the inactive period.)

Table IV.

The Examination of Ovaries of Inactive Sheep.

Sheep No.	Age.	Condition.	Weight.	Total period of testing.	Ovaries.				Graafian follicles.			Corpora lutea.	
					Left.		Right.		No. observed.		Largest		
					Weight.	Size.	Weight.	Size.	Left Ovary.	Right Ovary.		I.	II.
	years		lb.	days.	gm.	cm.	gm.	cm.			cm.	cm.	cm.
35645	6	Fair	81·0	307	0·55	1·5×0·3×0·7	0·81	1·6×1·1×0·9	2	7	0·5	0	0
35965	6	Fair	75·0	253	0·66	1·3×1·0×0·6	0·61	1·3×1·0×0·6	6	3	0·4	0·9×0·7	0·6×0·6

A close study of the results of the oestrous observations in Appendix 7, Tables VII to XII, will indicate that great difficulty is confronted in making an analysis for the interpretation of the results; this is due to marked individual differences of the time of the onset of the sexual season and the number of dioestrous cycles experienced during the period of observation, October, 1933, to April, 1934. Great individual variation has been seen to occur in all other experiments in which oestrous observations were extended over a long period of time. Out of the 60 sheep in this experiment, in only 3 cases did oestrus occur with great regularity; in 5 cases no oestrus was observed during 200 days of the experiment, although in 3 of the 5 cases, oestrus was observed after 208 to 240 days. Again, while in Groups IV and V the maximum number of dioestrous cycles, namely 10 and 12, was experiencmed by individuals, other individuals of the same groups experienced only 1, 2, or 3 dioestrous cycles during the same period. Due to the likelihood of such great variations, greater reliability of results would be obtained by increasing the numbers of sheep in each of the groups to 30. However, the results are of interest in that they may act as a guide to further investigation.

From Table II of the text it is seen that the sheep in Groups II and VI were least active; 36 and 48 dioestrous cycles respectively were experienced in these groups. Both groups were shorn during the spring or before the onset of the sexual season, and Group VI was inoculated prior to shearing. However, Group III was shorn at that time, and, while the activity exhibited by this group is greater than that of the former groups, 53 dioestrous cycles having been experienced, it is less than that of the unshorn groups in which from 54 to 60 dioestrous cycles were observed. The greater amount of sexual activity exhibited by the three groups which were not shorn during November, is due, in the cases of Groups IV and V, to the earlier onset of the sexual season, and, in Groups I and V, to the greater activity during the earlier part of the sexual season (Tables II and III). If the number of dioestrous cycles occurring during the first period, when no treatments were given, are deducted then the total number of cycles of Groups IV and V are affected and they become 51 and 56 respectively.

The analysis upon the periodicity of oestrus given in Table III of the text, indicates the absence of abnormal interoestrous periods in Group I, while the other groups, which were shorn in February, have 7-8 per cent. abnormal interoestrous periods. The November-shorn groups, II, III, and VI, have 16, 3, and 15 per cent. abnormal interoestrous periods; Group III received no other treatment but the November shearing. The mode of the interoestrous period of all groups is seen to be 17 days.

From the above, it appears evident that early summer shearing tends to inhibit sexual activity during the first few months of the sexual season. It is suggested that constant rains on shorn sheep during the heavy rainfall months of December and January may bring about slight inhibition of sexual activity (Diagram I). No biological explanation can be offered for the irregularity.

Two groups of sheep, I and VI, were inoculated against bluetongue. In Group VI inoculation was done at the customary time. The reaction to the inoculation is expected to take place between the 7th to the 15th day.

In the case of Group VI, the inoculation was given before the onset of the sexual season and there is no direct evidence to indicate that the inoculation postponed the onset of the sexual season. In Group I, the injection was given on February 5th; and, subsequent to that date during the same month, 7 sheep exhibited oestrus, while the total number of dioestrous cycles was 10 (Appendix 7, Table VII). There is no evidence to indicate that the inoculation inhibited the occurrence of oestrus.

The dipping of sheep in short or long wool, or dipping early or late during the sexual season, has no influence upon the onset of the sexual season or the regularity of the dioestrous cycles. Detailed evidence of these effects may be obtained by consulting the records giving the dates of dipping or the occurrences of oestrus of Groups II, IV, and VI in Appendix 7, Tables VIII, X and XII. In 18 out of 20 cases of sheep which showed oestrus during the periods between dippings, oestrus recurred with normal regularity. Within 26 days after the second dipping, not a single abnormal interoestrous period occurred in 22 sheep which were active during that period.

The results of the examinations of the ovaries of the two sheep in Group III, in which oestrus had not been observed for 307 and 253 days, reveal that in one case ovulation had recently occurred (Table IV). The occurrences of spurious ovulations in such cases has been remarked upon in Experiment 2. In both cases relatively few Graafian follicles are present.

Conclusions.

1. Observations were made on the effects of inoculation, shearing, and dipping on the body weight and sexual activity of 60 Merino ewes.

2. Shorn and unshorn sheep experience similar rapid increases in weight during the spring and early summer months. Spring-shorn sheep regain their pre-shearing weights within 2 to 3 weeks after shearing, but sheep shorn during the latter part of summer do not reflect such gains after shearing.

3. An insignificant temporary drop in body weight occurs after inoculation.

4. An insignificant temporary drop in body weight occurs after dipping.

5. Marked individual differences of the time of the onset of the sexual season and the number of dioestrous cycles exhibited occur, irrespective of the type of management practice adopted.

6. Early summer shearing appears to result in slight inhibition of sexual activity during the earlier part of the sexual season. The onset of the sexual season of some individuals is postponed and the percentage of abnormally long interoestrous periods is increased. These conditions are suspected to be a result of constant rain upon the shorn animals. No biological explanation can be given.

7. In sheep which are inoculated annually, inoculation against bluetongue in no way inhibits sexual activity.

8. The dipping of sheep in short or long wool has no influence upon the regularity of sexual activity.

9. Spurious ovulations occur in cases in which oestrus is found to be absent during the entire sexual season.

EXPERIMENT 9.

Artificial Induction of Oestrus during Anoestrum.

The results reported in the preceding experiments indicate that Merino sheep, and certain types of crossbred sheep, experience restricted annual sexual activity under the conditions obtaining at the Research Station. The sexual season of the sheep under observation was limited to the autumn and winter months, while an anoestrous period was found to occur during the remaining seasons of the year. However, marked differences in the degrees of polyoestrum were observed in individuals and nutrition was found to play an important rôle in influencing the degree of polyoestrum exhibited by sheep.

Restricted sexual activity such as evidenced limits the lambing season to the winter, spring, and early summer months. Under farm conditions, the growth of lambs during these seasons is greatly inhibited; the reasons for the retarded growth of such lambs were mentioned in previous sections. (The Physiographical Conditions, etc., The Methods of Sheep Husbandry, and Experiment 6). Also, attention was drawn to the fact that many Merino sheep farmers in the eastern districts of the Transvaal regulate lambing to occur during two seasons, the autumn and the spring, and, for reasons previously stated, the former season is preferred. Ewes which do not mate, or which are not successfully mated, during the spring and early summer months, are mated in the autumn. Farmers in these districts maintain that the lambing season of Merino ewes may be altered from the spring to the autumn, provided the necessary precautions of management and mating are observed. In other words, it is contended that it is possible to affect an alteration in the rhythm of the sexual season of Merino sheep under the conditions obtaining in these districts. Further reference to this aspect will be made in the latter part of the discussion of this experiment.

Artificial methods of inducing normal oestrus and ovulation in animals in which, for various reasons, oestrus does not occur, have received considerable attention during the past decade (Robson, 1934). The artificial method involves the administration of gonadotropic hormones in the form of extracts prepared from one of the following: anterior pituitary lobe, pregnant mare's serum, placenta, pregnancy urine. The last appears to be the most suitable material for the production of large quantities of extract (Robson, 1934).

Warwick and co-workers (1933) used a serum prepared from human pregnancy urine on goats during anoestrum and, while ovulation was produced in several cases, oestrus was not exhibited. The only successful application of an artificial method of inducing normal oestrus and ovulation in sheep during anoestrum which has come to the author's notice is that of Cole and Miller (1933). These authors used gonad stimulating hormone, the source of which was untreated serum from pregnant mares. It is stated that a single

injection of 50 R.U. or more, results in ovulation, but oestrus is not produced. Neither is oestrus induced by giving injections on several consecutive days. However, when a second injection of gonad stimulating hormone is given 16 days after the first injection, ovulation and oestrus result and a high percentage of fertility is obtained from matings made during such oestrous periods.

As Merino sheep under certain conditions exhibit a higher degree of polyoestrum than any other breed of the same species (Marshall, 1922; Quinlan and Maré, 1931), it may be thought that it would be more easy to induce ovulation and oestrus in Merinos during anoestrum in areas where restricted annual sexual activity is experienced.

" Prolan " is a standardized anterior pituitary hormone according to Zondek. The preparation is contended to bring about normal sexual activity resulting in successful fertilization in horses, cattle, and pigs, for which the required dosages are given as 125, 125, and 50 R.U. (rat units) respectively. No dosage is given for sheep.

The object of the experiment was to ascertain whether " Prolan " is capable of inducing normal oestrus during anoestrum in mature and young Merino sheep and in young crossbred sheep the dams of which were Merinos.

Materials and Methods.—The various sections, A to D, of the experiment were conducted during the anoestrous periods of the years 1933 to 1935. For the purpose of convenience, the portions are presented as one experiment which is seen to consist of nine groups of sheep (Table I).

The sheep used in the experiment were drafted from the Research Station's available flock, the general treatment of which has been described in a previous section (Experiment 1). However, in the case of Groups VIII and IX, the sheep had been under observation in Experiment 6 for 585 days before being utilized in this experiment.

Groups I to IV(*a*) consisted of mature Merino ewes, Groups V, VI, and VII each consisted of 5 Border Leicester-Merino and 5 Ryeland-Merino crossbreds 17 months old, and Groups VIII and IX consisted of Merino ewes 24 months old. It will be noticed that a control group was included in each of the five series of groups.

The sheep were tested for oestrus by means of vasectomised teasers once daily for at least 20 days prior to the first injection of " Prolan ", after which daily oestrous observations were continued. In the case of Groups VIII and IX, oestrous observations were made twice daily after the first injection of " Prolan ".

The precautions demanded in the instructions for the use of " Prolan " were observed. The inguinal regions of the sheep were washed without the use of soap and disinfectants, but the areas were sterilized with ether before the subcutaneous injections of " Prolan " were given.

The periods after which the various numbers of injections of " Prolan " were given to each group are indicated in the table of results.

With the exception of the sheep in Groups I and II, all sheep that showed oestrus during the period between injections and within 40 days subsequent to the last injection were control served by rams the fertility of which had been assured by sperm tests. Two services were given each sheep; the second service was allowed six hours after the first.

Results.

Table I gives complete details with respect to each of the Groups I to IX.

Discussion.

In the experiments reported here, 10 Merino ewes in Group II, treated with " Prolan " on 5.12.33, received 12·5 R.U. at each of two injections, the second injection having been given 7 days after the first.

It is seen that none of the sheep in the two groups exhibited oestrus during the period between injections, nor did sexual activity commence in Group II immediately after the second injection. In the control group, five sheep showed oestrus within 40 days after the second injection was given to Group II, and in the latter group 6 sheep showed oestrus during the same period. It has been seen in the results of previous experiments, that the sexual season of some Merino sheep may commence as early as the latter part of December (Experiments 1 and 8).

It may be concluded that " Prolan " had no effect in inducing oestrus in the treated sheep.

In section B, 20 Merino ewes were used in each of Groups III and IV, the latter group being given four injections of " Prolan " of 25 R.U. each at intervals of 6 days from 23.11.34.

It is seen that both in the control and the injected groups, one sheep showed oestrus during the periods between injections. Also, in each case three sheep exhibited oestrus and were served within 40 days subsequent to the last injection. In Group III (control), one showed a recurrence of oestrus after service, whereas in Group IV two returned for service. By 18.2.35, or 87 days after the first injection was given to Group IV, 9 sheep in Group III and 10 sheep in Group IV had not shown oestrus.

The above 19 sheep were used as a further test in which the 9 sheep of Group III constituted the control Group III (a) and the 10 sheep of Group IV constituted the treated Group IV(a).

Group IV(a) was given two injections of " Prolan " of 50 R.U. each at an interval of 16 days, or approximately the mode of dioestrum of Merino sheep (Experiment 3).

One control sheep exhibited oestrus between injections, and two of these sheep showed oestrus within 40 days subsequent to the last injection given Group IV(a). Four treated sheep showed oestrus within 40 days subsequent to the last injection. One of the former

and two of the latter sheep returned for service. It should be noted that during the latter part of February a certain percentage of sheep may be expected to have entered the sexual season (Experiment 1).

The results of the two systems of treatment with " Prolan " are negative.

In section C, 30 crossbreds, Border Leicester-Merino and Ryeland-Merino, 17 months old were used for the observations. It is seen from Experiment 6 that sheep of this type are in anoestrum at this age, but that 100 per cent. sexual activity can be expected in such sheep during the following sexual season or when they are from 19 to 22 months old. Therefore the time of treatment was just prior to the sexual season of 1935.

Groups VI and VII were given two injections of " Prolan " each of 50 and 75 R.U. respectively at an interval of 17 days. It appeared from the results of Experiment 6 that the dioestrous cycle of crossbred sheep is slightly longer than that of Merino sheep.

One sheep in Group VI exhibited oestrus during the period between injections. One sheep in each of Groups V and VI, and two sheep in Group VII showed oestrus shortly after the date of the second injection of " Prolan ". The latter two sheep returned for service. The inactivity of the sheep in all three groups was marked during the period of observations or for 56 days.

The administration of " Prolan " failed to induce oestrus in these sheep.

The sheep in section D were comparatively well grown Merino ewes of 24 months of age. The sexual histories of these sheep have been given in the results of Experiment 6. Only 40 per cent. of these sheep had shown sexual activity during the previous sexual season (1934), when they were 19 to 22 months old. It may be expected that all these sheep will show sexual activity during the coming sexual season (1936) or when they attain the age of 28 or 29 months (Experiment 1A). The sheep of Group IX were subjected to treatment when, as evidenced in all previously reported experiments, sheep are most inactive under these conditions.

Group IX was given two injections of " Prolan " each of 100 R.U. at an interval of 14 days.

No sexual activity was observed in the control and in the treated groups, and the results from " Prolan " are, therefore, negative.

It must be mentioned here that no definite explanation can be given for the high percentage of infertility which resulted from the services given. It will be noticed that a total of 16 ewes in sections B and C was served and that only 50 per cent. fertility was established. As previously mentioned the rams used were sperm tested; the microscopic examinations of the semen revealed the presence of very large quantities of highly motile normal spermatozoa and, therefore, such rams may be considered to have been highly fertile (McKenzie and Phillips, 1933). As the numbers concerned are small, the probability of incomplete oestrus, or oestrus without ovulation,

TABLE I.

The Use of "Prolan" to induce Oestrus during Anoestrum.

Group.	No. of sheep.	Breed or type.	Age of sheep.	Mean weight of group at time of injection.	Period of testing for oestrus before first injection.	No. of sheep exhibiting oestrus within 40 day period preceding first injection.	Date of first injection.	No. of injections.	Periods between injections.	Quantity of "Prolan" given each sheep at each injection.	No. of cases in which oestrus occurred during the periods between injections.	No. of cases in which oestrus occurred within 40 days subsequent to the last injection, or after the following periods indicated in days (*a*). Days. 1.	2.	6.	7.	9.	10.	12.	13.	18.	20.	22.	23.	27.	28.	29.	30.	33.	35.	No. of cases in which oestrus did not occur throughout the entire period of testing (*b*).
				lb.	Days.				Days.	R.U.																				
A. I.....	10	Merino	Mature	76·0	20	—	Control	—	—	—	—	—	—	—	—	—	1	—	1	—	—	1	1	—	1	—	—	—	—	0 (167 days).
II.....	10	,,	,,	76·0	20	—	5.12.33	2	7	12·5	—	—	—	—	—	—	—	1	—	—	1	—	1	1	—	—	1	—	1	1 (,,).
B. III.....	20	Merino	Mature	71·3	20	—	Control	—	—	—	1	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	(1)	—	—	—
IV.....	20	,,	,,	70·4	20	—	23.11.34	4	6	25	1	—	—	(1)	—	—	—	—	—	(1)	—	1	—	—	—	—	—	—	—	—
III (*a*).....	9	,,	,,	76·5	105	—	Control	—	—	—	1	—	—	—	—	—	—	—	1	—	—	—	—	—	(1)	—	—	—	—	7 (63 days).
IV (*a*).....	10	,,	,,	74·3	105	—	18.2.35	2	16	50	—	—	—	—	—	—	—	(1)	—	—	—	—	—	—	1	(1)	—	1	—	6 (,,).
C. V.....	10	Crossbreds	17 mths.	67·0	20	2	Control	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	9 (56 days).
VI.....	10	,,	,,	65·2	20	—	28.2.35	2	17	50	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	9 (,,).
VII.....	10	,,	,,	69·5	20	—	28.2.35	2	17	75	—	—	(2)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8 (,,).
D. VIII.....	5	Merino	24 mths.	62·2	585	—	Control	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5 (136 days).
IX.....	5	,,	,,	62·2	585	—	1.10.35	2	14	100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5 (,,).

NOTE.—(*a*) With the exception of the sheep in Groups I and II, all sheep showing oestrus within the 40 day period were served. The cases which were not fertilized by such services have been placed in brackets.

(*b*) The length of the entire period of testing for oestrus is indicated in brackets in this column. In the case of Groups VIII and IX, the period has been considered from the date of the last occurrence of oestrus during the previous sexual season.

cannot be considered. No experimental evidence is available to indicate that low fertility results when ewes are mated at the onset of their sexual seasons.

The possibility of artificially inducing normal oestrus by the administration of gonad stimulating hormones is a matter of considerable practical importance to stud and flock owners.

Stud breeders frequently find that valuable animals will not breed. It is not known whether the majority of such cases of infertility are due to the presence of pathological conditions resembling some of those encountered in bovines (Hammond, 1927; Quinlan, 1929), or to obesity as suggested by Quinlan and Maré (1931), or merely to an unaccountable quiescent or even static state of the ovaries perhaps due to the absence of breeding. The probability exists that, in certain cases, the mating of such sheep is restricted to a particular time, and that such individuals may experience exceptionally few dioestrous cycles during the entire year, as has been evidenced to occur in certain sheep under observation in many of the experiments reported in this thesis. However, it is possible that the administration of gonadotropic hormones may overcome some of the causes of infertility in stud sheep, and that, once the genital organs are set in motion, normal annual reproduction will result.

Whether the application of successful artificial methods of inducing normal oestrus will be extended to flocks will depend upon the price of the preparations. In general flock practice, unproductive ewes are marked and eventually culled during the annual classing. However, a problem of great concern to the flock owner is that of obtaining a high percentage of lambs at a time which is most favourable for the health and growth of the lambs.

Previous mention has been made of the fact that both autumn and spring-born lambs are obtained in these districts. The author has been in intimate contact for three years with the mating operations during the spring months of two Merino sheep farmers within a radius of 14 miles of the Research Station. These owners employed the system of control serving, and, during the months of October and November, large numbers of ewes were served, while during those months at the Research Station, the sheep under observation were in anoestrum. The assurance given by experienced sheep farmers, that the season of lambing of Merino ewes under these conditions, may be altered from the spring to the autumn months by careful regulation of the time of mating, by early weaning of the lambs, and by maintaining the sheep in good condition, suggests an an explanation for the existence of two lambing seasons. No doubt is expressed as to the possibility of the alteration of the period of lambing, although the method of effecting the change has not been subjected to experimentation. It is not known whether it is possible to convert all Merino sheep, whether the sexual season of the converted sheep occupies the full period of anoestrum of spring lambing sheep, whether in the absence of breeding the former sheep revert back to the condition in which the sexual season is restricted to the autumn and winter months, and whether autumn lambing sheep experience a shorter anoestrum or one of equal length to that of spring lambing sheep.

During several years of experience in the eastern Transvaal highveld, the author has constantly come in contact with sheep farmers who have become alarmed about the abnormally low lambing percentages obtained by them, cases in which lambing results as low as 50 and 40 per cent. have been reported.

Many farmers have observed a tendency of their ewes to lamb in the spring rather than in the autumn. In a recent number of an agricultural periodical (*Farmer's Weekly*, November 13, 1935), a Karroo farmer remarks upon "ewe idiosyncrasies". He states that it is exceedingly difficult to obtain more than half his lambs from the October to December mating, that some ewes have never lambed in the autumn, although they have lambed with great regularity in the spring, and he concludes that some ewes are willing to lamb only in the spring.

The above general remarks have been made in order to present briefly the problems encountered by Merino stud and flock owners, and to indicate the field for the application of scientific measures for ensuring higher fertility, which would assist very materially in rendering the sheep enterprise more remunerative.

Conclusions.

1. A standardized anterior pituitary hormone, "Prolan", was given subcutaneously with the object of inducing normal oestrus in Merino and crossbred sheep during anoestrum.

2. The following methods of administering the hormone failed to induce oestrus in the types of sheep mentioned:—

(*a*) Mature Merino ewes received two injections of 12·5 R.U. each at an interval of 7 days.

(*b*) Mature Merino ewes received four injections of 25 R.U. each at intervals of 6 days.

(*c*) Mature Merino ewes received two injections of 50 R.U. each at an interval of 16 days.

(*d*) Merino ewes 24 months of age received two injections of 100 R.U. each at intervals of 14 days.

(*e*) Border Leicester-Merino and Ryeland-Merino crossbreds 17 months of age received two injections of 50 R.U. each at an interval of 17 days.

(*f*) Border Leicester-Merino and Ryeland-Merino crossbreds 17 months of age received two injections of 75 R.U. each at an interval of 17 days.

3. The field for the application of artificial methods of inducing oestrus in commercial studs and flocks is discussed.

PART 2.

THE REFLECTION OF SOME PRINCIPLES OF SEX PHYSIOLOGY IN PRACTICAL SHEEP HUSBANDRY.

The data presented and discussed in this section have not been obtained from experimental findings, but by analysing:—

A. Extracts from Merino stud registers.

B. The observations of reliable stud breeders in various parts of South Africa upon the breeding habits of sheep .

The results of the analysis of such records and observations have not been appended to attempt to render the experimental findings reported in this thesis more complete, but rather with the view of presenting some information, although limited, to indicate the ways in which some principles of sex physiology are expressed under practical conditions of sheep husbandry. It is contended that closer observation and the analysis of breeding records will assist very materially in elucidating many practical breeding problems, which are of immense and far-reaching economic importance.

A. The Analysis of Extracts from Merino Stud Registers.

It is not desired that animals should be compelled to reproduce when the process would endanger normal growth and development, yet it is most certainly of great economic importance that best use should be obtained of the full length of the period of the animal's life during which reproduction is possible.

The main object of this analysis is to obtain information upon the length of the reproductive life of Merino ewes belonging to studs at Government Institutions, in which modern methods of management, selection, and breeding have been practised for very many years. It is possible that the results will suggest methods of management, selection, and breeding which would tend to improve fertility in studs.

(*a*) *Mating Maiden Merino Stud Ewes.*

The results of mating Merino ewes in three Studs A, B, and C, maintained under Cape (Karroo), Transvaal, and Free State conditions respectively, have been analysed, and the respective results are given in Tables I, II, and III.

It will be noticed that in the Case of Stud A, Table I, the control or hand service method of mating was employed, while, in studs B and C, the small paddock system of mating was used; consequently, the information with regard to Stud A is more complete than in the cases of the latter two studs.

TABLE I.

MATING MAIDEN MERINO STUD EWES.

Stud A: (Controlled or Hand Service Mating).

Mating season.	Total No. of ewes available for mating.	Age at time of mating.		Ewes mated.		Lambs out of ewes mated.		Lambs from Total No. of available ewes.
		Range.	Average.	No.	Per cent. of total.	No.	Per cent.	
		Months.	Months.					Per cent.
1929.....	33	16–19	17·3	23	69·7	15	65·2	45·5
1930 (*a*)*...	9	19–21	19·8	9	100·0	5	55·6	55·6
1930 (*b*)....	32	22–27	25·9	26	81·2	13	50·0	40·6
1931.....	52	15–23	19·9	52	100·0	37	71·2	71·2
1932.....	41	18–26	20·1	32	78·0	19	59·4	46·3
1933 (*c*)....	63	15–21	18·8	46	73·0	29	63·0	46·0
1933 (*d*)....	22	24–27	25·2	16	72·7	10	62·5	45·4
For all seasons...	252	15–27	21·0	204	81·0	128	62·7	50·8

*NOTE.—(*a*) Sheep were born in the autumn and mated in the spring at 19·8 months.
(*b*) Sheep were born in the autumn and mated in the autumn at 25·9 months.
(*c*) Sheep were born in the autumn and mated in the spring at 18·8 months.
(*d*) Sheep were born in the spring and mated in the spring at 25·2 months.

TABLE II.

Stud B: (Small Paddock Mating).

Mating season.	Total No. of ewes mated.	Average age at time of mating.	Lambs born.	
			No.	Per cent.
		Months.		
1929.....	11	—	5	45·4
1930.....	2	21	1	50·0
1931.....	8	18	4	50·0
1932.....	7	21	3	42·8
1933.....	17	25	6	35·2
1934.....	16	21	11	68·8
For all seasons.....	61	21·2	30	49·2

TABLE III.

Stud C: (Small Paddock Mating).

Mating season.	Total No. of ewes mated.	Average age at time of mating.	Lambs born.	
			No.	Per cent.
		Months.		
1930.....	31	21	20	64·5
1931.....	34	19	11	32·4
1932.....	16	20	3	18·8
1933.....	21	20	8	38·1
For all seasons.....	102	20	42	41·2

Discussion.

Quinlan, Maré, and Roux (1930) state that Merino ewes show oestrus regularly at the ages of 9 to 10 months,; 100 per cent. sexual activity was observed at that age.

The usual stud practice is to mate maiden ewes when they are 18 to 20 months old; at this age such sheep are well grown and pregnancy does not inhibit further development, so that by the end of the gestation period, the sheep are approximately 24 months old, fully grown, and able to stand the more severe strain of lactation (Parkes 1929).

It is seen from Tables I, II, and III that the ages of mating conform to the above stud practice, except in the case of the 1930 (*b*) season when autumn-born lambs were mated in the autumn at 25·9 months of age, and the 1933 (*d*) season when spring-born lambs were mated in the spring at the age of 25·2 months (Stud A, Table I).

The percentage of the available ewes actually served was obtainable only in the case of Stud A, in which controlled serving was practised; this percentage during the seven mating seasons is seen to range between 69·7 and 100 per cent., the average being 81·0 per cent. (Table I). The fertility established in these matings is given, and it is seen to range between 50·0 and 71·2 per cent., the average for the seven seasons being 62·7 per cent. Yet more interesting, are the percentages of lambs obtained from the total number of available maiden ewes; this figure ranges between 40·6 and 71·2 per cent., the average being 50·8 per cent. (Table I).

These percentages of successful matings in the case of Stud A, may be compared with those in Studs B and C, in which small paddock mating was practised. Marked variations in fertility occur also in the latter two studs, and the fertility for all seasons is equally poor in the case of Stud B, being 49·2 per cent. (Table II), and appreciably poorer in the case of Stud C, being 41·2 per cent. (Table III). The results in the latter case are for only four seasons, but 102 sheep are involved.

It is very evident that the fertility of Merino stud ewes 18 to 25 months old in the studs examined is very low. The infertility of such ewes is due to approximately 20 per cent. of the ewes not showing oestrus during the mating period, and approximately 40 per cent. of the ewes mated not being fertilized.

In connection with the results obtained in the case of Stud A, it is of interest to consider the types of seasons experienced. For the particular area, the South African Karroo, the rainfall records are considered an excellent guide; these records are given in Table IV.

By studying the results reflected in Table I and the rainfall records in Table IV, it is not evident that a high correlation exists between high sexual activity (ewes mated) and high rainfall, or high fertility (successful matings) and high rainfall. Both 1928 and 1929 were average to good rainfall years, and abundant spring rains were experienced during 1929; yet only 69·7 per cent. of ewes were served, 65·2 per cent. of which lambed, and only 45·4 per cent. of the total number of ewes lambed. The rainfall during 1930 was only 8 inches, the spring rains in 1931 were late, and not much rain was experienced even during October and November, the months of mating; yet 100 per cent. of ewes were mated, and the percentage fertility reflected in the number of lambs obtained, 71·2 per cent., was higher than that of any other season.

Interesting information with regard to the influence of season of birth upon the eventual seasonal sexual activity has become available in the analysis of the records of Stud A.

Russell (1919), working with Rambouillets and several British breeds and their crosses in the United States, considers that evidence was revealed which indicates that spring-born lambs tend to produce spring lambs, and autumn-born lambs tend to produce autumn lambs.

In this connection, the following extracts taken from Table I are of interest:—

(1) In the season 1930 (*a*), 100 per cent. of sheep born in the autumn were mated in the spring at 19·8 months of age, and 55·6 per cent. fertility was obtained.

(2) In the season 1930 (*b*), 81·2 per cent. of sheep born in the autumn were mated in the autumn at 25·9 months of age, and 50 per cent. fertility was obtained.

(3) In the season 1933 (*c*), 73·0 per cent. of sheep born in autumn were mated in the spring at 18·8 months of age, and 63 per cent. fertility was obtained.

(4) In the season 1933 (*d*), 72·7 per cent. of sheep born in the spring were mated in the spring at 25·2 months of age, and 62·5 per cent. fertility was obtained.

It is evident that the above information upon young Merinos under South African Karroo conditions, does not bear out Russell's contention.

TABLE IV.

Rainfall Records: Area of Stud A.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1928.....	2·61	0·76	2·04	1·25	0·04	0·05	0·03	0·13	1·38	0·80	1·11	1·51	11·73
1929.....	1·78	0·89	2·28	0·12	1·44	0·41	1·42	0·74	4·01	1·78	1·61	1·97	18·45
1930.....	2·08	0·63	3·36	0·24	0·27	0·49	0·02	0·28	0·04	0·47	0·58	0·40	8·86
1931.....	2·66	0·94	2·61	0·97	0·00	0·10	2·94	0·07	0·06	1·15	1·75	2·91	16·16
1932.....	0·35	1·59	1·32	0·06	0·58	0·00	0·42	0·00	2·39	0·47	1·79	1·33	10·30
1933.....	0·90	0·38	3·24	1·02	0·02	0·05	0·26	0·56	0·41	0·00	4·92	2·53	14·29

Conclusions.

1. Data were obtained by considering a total of 415 maiden Merino ewes in three studs maintained under Cape (Karroo), Transvaal, and Free State conditions.

2. Approximately 20 per cent. of maiden Merino ewes, between the ages of 18 to 25 months, do not experience a continuous series of dioestrous cycles during the recognized mating seasons. Under South African Karroo conditions, mating may be undertaken in the autumn and spring seasons.

3. Approximately 40 per cent. of maiden Merino ewes mated are not rendered fertile.

4. The percentage of maiden Merino ewes that lamb during the ages of 23 to 30 months is only 41 to 51 per cent.

5. The controlled service method of mating has the advantage of revealing cases in which sexual activity is absent and in which fertility has not been established by mating. This method of mating is recommended in the case of maiden ewes, because it indicates the need for extending the mating period. It is considered desirable to set the reproductive processes of young ewes in motion as soon as possible after they are 18 months of age.

(*b*) *The Breeding Histories of Prolific Merino Ewes.*

The breeding records of thirty of the most prolific ewes have been extracted from each of three Merino stud registers. The studs are referred to as Studs A, B, and C, which were maintained under Cape (Karroo), Transvaal, and Free State conditions respectively. The details of individual ewes in the studs are given in Tables V, VI, and VII respectively.

Table VIII has been constructed from the above Tables V to VII in order to permit a comparison of the different studs.

Discussion.

No data upon the reproductive capabilities of stud Merino sheep under South African conditions have been analysed and published. There is no doubt that a more intimate knowledge of the breeding histories of the individuals in studs would assist greatly in the establishment of higher fertility, as this character, like all body characters, has a genetic basis.

While it is realised that a more thorough analysis embracing animals of high and low fertility would yield more valuable information, so complete an analysis is not possible here owing to the excessive amount of data that would have to be presented. By considering the 30 most prolific ewes on record in each of three studs, a conception of the highest degree of fertility in these studs will be obtained and this will serve as a guide.

Age at First Successful Mating.—In Stud A, the ewes were born during the years 1921 to 1926 (Table V). The ages at the first successful matings ranged between 18 and 32 months, the average being 21·0 months (Table VIII). It has been computed from the former table that 90 per cent. of the ewes were successfully bred at the ages of 18 to 24 months.

TABLE V.

The Breeding Histories of the Most Prolific Ewes in Merino Stud Register A.

Sheep No.	Date of birth.	Age at first successful mating.	Life period of lambing.	No. of lambs produced	Sets of twins.	Present age or age at disposal or death.	Spring lambing preceded by, and followed by autumn lambing.	Non-lambing years.	Remarks.
		months.	years.			years.	dates.		
D.B. 114.	20.4.24	19·25	7·0	10	2	8·75	—	—	Died 1933.
M 603....	23.6.23	18·25	9·25	13	4	11·5	13.3.32, 20.10.33	—	In stud.
M 611....	29.6.23	20·25	6·5	9	2	—	—	1926	Disposed of—old.
M 761....	5.6.25	18·5	5·75	6	—	8·0	—	—	Missing 1933.
M 880....	7.4.26	19·5	5·75	6	—	8·0	25.3.30, 4.10.31, 8.3.33	1932	Sold 1934.
T 343....	5.6.25	19·5	6·5	8	1	8·0	—	—	Died 1933.
T 384....	19.4.26	22·0	8·25	11	3	8·75	7.5.30, 7.10.31, 17.4.32, 28.3.33, 20.10.33	—	In stud.
T 307....	3.6.24	22·0	5·75	6	—	7·0	—	—	Died 1931.
T 331....	3.6.24	18·75	5·75	6	—	10·0	—	—	Discarded 1934.
T 367....	2.4.26	22·0	6·5	7	—	8·0	22.4.30, 4.10.31, 27.6.32	—	Sold 1934.
D.B. 123.	20.5.22	31·75	7·75	10	4	12·0	—	1928, 1929	Culled 1934.
T 287....	16.6.23	28·5	8·75	11	2	11·0	—	—	Died 1934.
T 293....	25.6.23	18·0	8·75	9	—	11·0	—	—	Missing 1934.
T 338....	5.6.25	18·25	7·75	10	2	9·75	—	—	In stud.
D.B. 95..	21.3.26	20·5	7·75	10	3	8·0	26.9.31, 26.4.32	1930	Discarded—old age, 1934.
D.B. 91..	5.6.21	29·5	8·75	8	—	11·0	1.5.26, 25.9.27, 24.6.28	—	Discarded 1932.
D.B. 109.	13.4.26	22·0	5·25	6	—	7·0	—	—	Died November, 1933.
M 807....	22.6.25	24·75	7·25	8	—	9·0	—	—	Discarded 1934.
M 440....	30.4.21	24·0	6·5	8	1	10·0	15.9.23, 22.6.24	—	Died 1931.
D.B. 113.	20.4.24	19·5	7·75	10	2	9·0	—	—	Died December, 1933.
M 882....	9.4.26	19·5	6·75	9	2	8·0	9.4.30, 24.9.31, 8.7.32	—	Discarded 1934, still alive.
M 731....	26.5.25	22·0	6·5	9	2	10·0	8.9.27, 30.5.28	—	In stud.
M 756....	26.5.25	19·0	5·75	8	2	8·0	—	—	Missing 1933.
M 789....	11.6.25	18·75	7·75	9	1	9·0	—	—	Discarded 1934.
M 599....	1.7.23	20·0	8·5	9	—	11·0	—	—	Culled 1934.
M 534....	2.5.22	21·0	10·5	11	1	12·0	—	1925	In stud.
M 830....	21.4.26	21·25	7·25	10	3	8·0	30.3.33, 20.10.33	—	Died 1934.
T 268....	17.4.22	20·0	8·75	10	1	10·0	—	—	Died 1932.
T 278....	6.5.23	19·5	8·75	10	1	11·0	—	1927	Died 1934.
T 282....	27.5.23	19·5	8·75	11	2	11·0	—	—	Died 1934.
Totals....	—	638·0	222·5	269	41	273·75	—	7	—
Averages..	—	21·0	7·42	9	—	9·12	—	—	—

TABLE VI.

The Breeding Histories of the Most Prolific Ewes in Merino Stud Register B.

Sheep No.	Date of birth.	Age at first successful mating.	Life period of lambing.	No. of lambs produced.	Sets of twins.	Present Age or age at disposal or death.	Non-lambing years.
		months.	years.			years.	
1295 Z	2.5.18	33	8	7	—	11·75	1926
3 C 48	19.4.23	32	6	7	2	10·25	1928
3 D 63	5.4.23	33	4	5	1	7·0	—
4 C 80	21.3.24	44	4	7	3	9·25	—
4 C 87	18.4.24	55	4	5	1	9·5	—
3 B 31	29.3.33	31	7	7	—	12·0	—
3 B 49	29.3.23	55	4	5	1	12·0	—
3 HR 57	4.4.23	55	4	4	—	10·0	—
3 D 71	20.4.23	45	6	5	—	10·5	—
S D J 127	15.5.25	42	5	6	1	10·0	—
6 G 201	24.4.26	31	5	5	—	9·0	—
6 H 251	7.4.26	43	6	5	1	9·0	1932
6 C 253	21.4.26	20	7	6	1	9·0	1933, 1934
1470	15.3.22	60	5	6	1	11·25	—
1459	15.3.22	32	5	5	—	11·0	—
1478	15.3.22	32	7	5	—	11·25	1928, 1929
1483	15.4.22	45	5	4	—	11·0	1928
1486	15.4.22	55	5	6	1	10·25	—
1487	17.4.22	45	5	6	1	11·5	—
1490	18.4.22	31	7	6	—	11·25	1928
1602	15.4.24	23	7	8	2	9·25	1928
1603	15.4.24	23	4	4	—	8·75	—
1616	15.4.24	18	5	4	—	9·0	1930
1435	15.4.21	43	5	4	—	12·5	1928
1426	10.6.21	41	4	4	—	12·0	1932, 1933
1391	15.4.21	69	4	4	1	12·25	1931
5 Q 123	15.4.25	23	6	4	—	10·75	1931, 1933
6 C 234	26.4.26	21	7	4	—	9·0	1932, 1933, 1934
6 H 235	26.3.26	22	6	4	—	9·25	1932, 1934
1604	15.4.24	23	4	4	—	8·75	—
Totals	—	1,125	161	156	17	308·25	22
Average	—	37·5	5·25	5·2	—	10·5	—

TABLE VII.

The Breeding Histories of the Most Prolific Ewes in Merino Stud Register C.

Sheep No.	First lambing recorded.		Life period of lambing.	No. of lambs produced.	Sets of twins.	Present age or age at disposal or death.	Non-lambing years.	Remarks.
	Age.	Year.						
	months.		years.			years.		
D.O.A. 11	18–24	1914	8	9	1	11	—	Died 1923.
D.O.A. 54	„	1915	9	10	1	11	1916	Died 1924.
90	„	1914	8	9	3	13	1915, 1916, 1920	Died 1925.
102	„	1917	8	7	—	11	1918	Died 1926.
106	„	1916	9	9	—	10	—	Died 1924.
107	„	1916	9	9	—	11	—	Died 1925.
118	„	1916	8	8	—	9	—	Died 1923.
381	„	1920	8	8	—	9	—	Died 1927.
531	„	1921	10	8	—	11	1927, 1928,	Missing.
586	„	1921	7	7	—	9	1923	Culled—old age.
594	„	1921	7	7	—	11	—	Culled 1930.
595	„	1921	9	9	—	12	—	Slaughtered 1931—old.
601	„	1921	8	8	—	12	—	Killed 1931—old.
602	„	1922	9	12	3	11	—	Slaughtered 1931—old.
617	„	1921	8	11	3	12	—	Slaughtered 1931—old.
625	„	1921	7	9	2	10	—	Died 1929.
632	„	1921	10	12	2	13	—	Culled 1932.
640	„	1921	9	9	—	12	—	Killed 1931—old.
644	„	1921	10	11	1	11	—	Culled 1930—old.
652	„	1921	9	14	5	11	1929	Died 1930.
686 E	„	1922	8	10	2	10	1923	Culled 1930.
684 E	„	1922	9	11	2	11	—	Missing.
724	„	1923	8	8	—	11	—	Missing.
725	„	1924	9	11	2	10	—	Culled 1932.
727	„	1924	9	11	2	11	—	Culled 1932.
731	„	1923	9	10	1	11	—	Slaughtered 1932—old.
732	„	1923	9	11	2	11	—	Culled 1932.
777	„	1925	6	8	3	11	1927	Culled 1931.
923	„	1927	7	8	1	10	1933	In stud.
62	„	1929	6	10	4	8	—	In stud.
Totals	—	—	250	284	40	324	12	
Averages	—	—	8·25	9·25	—	10·75	—	

TABLE VIII.

The Breeding Histories of the Most Prolific Ewes in Three Merino Studs.

Stud (*c*).	Age at first successful mating.		Life period of lambing (years).								No. of lambs produced.													Sets of twins.						Total non-lambing years (*c*).	Final average ages (*b*) (years).		
	Range.	Average.	Average.	Frequencies (*a*).							Total.	Average.	Frequencies.											Total No.	Frequencies.						Present in stud.	Disposed of.	At death.
				4	5	6	7	8	9	10			4	5	6	7	8	9	10	11	12	13	14		1	2	3	4	5				
	months	months																														
A. (30)...	18–32	21·0	7·42	—	1	10	4	7	7	1	269	9·0	—	—	5	1	4	7	8	4	—	1	—	41	6	9	3	2	—	7 (6)	10·4	9·3	9·0
B (30).....	18–69	37·5	5·25	9	9	5	6	1	—	—	156	5·2	11	8	6	4	1	—	—	—	—	—	—	17	10	2	1	—	—	22 (15)	—	—	—
C (30)....	18–24	—	8·25	—	—	2	4	9	12	3	284	9·4	—	—	—	3	7	7	4	6	2	—	1	40	5	7	4	1	1	12 (9)	9·0	10·8	11·0

NOTE :—

(*a*) For the life period of lambing frequencies, the ages of the sheep were considered to the nearest 12 months.

(*b*) In the case of the final average ages given, sheep culled are included under the heading " disposed of " and sheep slaughtered are included under the heading " at death " as the latter may be considered to have reached an unproductive stage.

(*c*) The numbers in brackets indicate the number of individual sheep involved.

In Stud B, with the exception of one ewe, No. 12952, the ewes were born during the same years as those of Stud A (Table VI). In Stud B, the ages of the first successful matings ranged between 18 and 69 months, the average being 37·5 months (Table VIII). It has been computed from the former table that only 26·7 per cent. of the first successful matings occurred during the ages of 18 to 24 months.

In the case of Stud C, the ewes were born during the years 1914 to 1917 and 1920 to 1929. The exact date of birth of the ewes is not available, but it has been reported that the sheep were successfully mated at the ages of 18 to 24 months (Table VII).

Life Period of Lambing.—The life period of lambing is a figure of particular interest, as it not only indicates the duration of the reproductive period, but also reflects the general ability of the sheep to exist under the particular conditions. The value of the figure is reduced somewhat by the presence of sheep which were reported as "missing"; also, some individuals are at present in the studs so that their reproductive periods may not have terminated.

The life periods of lambing of the three studs are reflected in the ultimate analysis presented in Table VIII, in which the periods have been considered to the nearest 12 months. The periods are seen to range from 5 to 10 years, 4 to 8 years, and 6 to 10 years in Studs A, B, and C respectively, and the respective averages are 7·42, 5·25, and 8·25 years. The frequency columns indicate that, in the case of Stud A, the modal life period of lambing is only 6 years, although in 50 per cent. of cases this period extends between 8 and 10 years. In Stud B, the modes are only 4 and 5 years, and nearly 50 per cent. have a life period of lambing between 4 and 6 years. The period, in the case of Stud C, is appreciably longer; the mode is 9 years, and in 80 per cent. of cases the life period of lambing is 8 to 10 years.

Number of Lambs Produced.—The Merino is not a fecund breed; twins and triplets are not frequently produced. As the Merino is essentially a wool producing breed, it is not unlikely that selection for wool qualities has been carried out to the detriment of fertility. In this connection, it is of interest to mention a case of abnormal fecundity reported by Pearl (1913), of a ewe which gave 19 fleeces and bore 36 full grown lambs among which there were 7 sets of twins and 6 sets of triplets. It is also of interest to place on record a case reported by Mr. Gadd, Springfield, Tafelberg, Cape, of a Blackhead Persian ewe that attained the age of 28 years during which time she bore and reared 30 lambs.

An analysis of the lambs produced by the three studs under consideration is given in Table VIII.

The average number of lambs produced by Studs A, B ,and C was 9·0, 5·2, and 9·4 respectively.

The frequency columns of the table reveal further details. In Stud A, the mode of the number of lambs produced is 10, in Stud B only 4, and in Stud C 8 and 9. In 66·7 per cent. of cases in Studs A and C, 9 to 13, and 9 to 14 lambs were produced respectively, whereas in Stud B ,the maximum number of lambs produced was only 8, and in 63·3 per cent. of cases only 4 and 5 lambs were produced.

In the case of Stud A, certain ewes produced lambs during the autumn and during the following spring (Table V). This would increase the number of lambs that would have been produced beyond the number likely to have resulted, if the usual one annual lambing had been practised.

Sets of Twins.—The fecundity of the ewes is reflected in the sets of twins produced (Table VIII).

The total number of sets of twins produced is nearly similar in Studs A and C, namely 41 and 40 respectively; the equivalent figure for Stud B is only 17. Twins were produced by 66·7 per cent. of cases in Stud A, 43·3 per cent. in Stud B, and 60·0 per cent. in Stud C (Tables V, VI, VII). In Studs A and C the modal number of sets of twins produced during a life period is two, and in Stud B one.

Non-lambing Years.—The non-lambing years indicate the absence of reproduction and they are to be considered in estimating the fertility of a stud.

The total number of non-lambing years in Studs A, B, and C were 7, 22, and 12 respectively, and these occurred in a total life period of lambing years of 222·5, 161, and 250 respectively (Tables V, VI, and VII).

In Stud A, five sheep missed one, and one sheep missed two lambing seasons (Table V). In Stud B, nine sheep missed one, five sheep missed two, and one missed three lambing seasons (Table VI). In Stud C, seven sheep missed one, one sheep missed two, and one sheep missed three lambing seasons (Table VII).

Autumn and Spring Lambing.—In general practice, it is not desired that ewes that lamb in the autumn should lamb during the next spring, because of the heavy drain on the sheep. In some areas the possibility of such intensive reproduction in the case of Merinos would be questioned.

Parkes (1929) states that there is no cyclical ovarian change during lactation in the sheep, but Quinlan and Maré (1931) found that, in Merinos under South African Karroo conditions, ovulation may occur within 10 to 15 days following normal parturition and the latter authors state that such " ovulation is not accompanied, as a rule, by the physiological exhibition of heat when the ewe suckles her lamb ", although when the lamb is still-born " ovulation accompanied by normal oestrus may occur as early as 17 days after parturition ".

The analysis given in connection with Stud A, Table V, contains some data upon this phase. Such data have been extracted and presented in the following Table IX, which contains the lambing dates of cases in which spring lambing was preceded and followed by autumn lambing. The period between lambings, or the intermediate period, has been divided into the gestation period and the period of lactation and rest. Quinlan, Maré, and Roux (1932) found the gestation period of Merino sheep to be 151 days; this figure has been used to determine the period of lactation and rest. Unfortunately the exact ages at which the lambs were weaned are not known, but the practice at the institution is to wean lambs at the age of 3½-4 months.

Table IX.

Autumn and Spring Lambing.

Sheep No.	Autumn lambing.	Spring lambing.	Intermediate period.			Autumn lambing.	Intermediate period.		
			Total.	Gestation.	Lactation and rest.		Total.	Gestation.	Lactation and rest.
	Date.	Date.	Days.	Days.	Days.	Date.	Days.	Days.	Days.
M. 603.....	13.3.32	20.10.33	584	151	433	—	—	—	—
M. 880.....	25.3.30	4.10.31	556	151	405	8.3.33	881	151	730
T. 384.....	7.5.30	7.10.31	516	151	365	17.4.32	189	151	38
T. 384.....	28.3.33	20.10.33	204	151	53	—	—	—	—
T. 367.....	22.4.30	4.10.31	163	151	12	27.6.32	263	151	112
D.B. 95.....	—	26. 9.31	—	—	—	26.4.32	211	151	60
D.B. 91.....	1.5.26	25. 9.27	510	151	359	24.6.28	270	151	119
M. 440.....	—	15. 9.23	—	—	—	22.6.24	278	151	127
M. 882.....	9.4.30	24. 9.31	531	151	380	8.7.32	285	151	134
M. 731.....	—	8. 9.27	—	—	—	30.5.28	262	151	111
M. 890.....	30.3.33	20.10.33	202	151	51	—	—	—	—

From Table IX it appears that in some cases successful mating took place a relatively short period after parturition, indicating that ovulation and oestrus occurred at that time.

The periods from parturition to the time of the next successful mating which resulted in the alteration of the season of lambing were: 12, 38, 51, 53, 60, 111, 112, 119, 127, 134, 359, 365, 380, 405, 433, and 730 days. In general practice, the lactation period and the period of rest before mating takes place, make up a total of 214 days. Hence, the above periods of 12 to 134 days are exceptionally short, and the periods of 359 to 730 days are abnormally long. It must be pointed out that, in the above instances of short rest periods, only in the case of the 38-day period did the lamb die at or shortly after birth. In the other cases in which the lactation and rest periods were 12 to 134 days, the lambs are reported to have suckled their dams; these are, therefore, cases of exceptional early ovarian activity after parturition. The longer periods of 359 to 730 days indicate that, for some reason or other, mating, or perhaps successful mating, did not occur at the usual time. However, it must be noted that successful mating did eventually occur during a season other than that during which the previous successful mating took place.

Conclusions.

1. The breeding histories of a total of 90 of the most prolific Merino ewes out of three studs maintained under Cape (Karroo), Transvaal, and Free State conditions, have been analysed.

2. The age at the first successful mating:—

   (*a*) Under Karroo conditions, 90 per cent. of prolific ewes are successfully mated at the ages of 18 to 24 months. The average age for all cases is 21 months.

   (*b*) Under Transvaal conditions, approximately 27 per cent. of prolific ewes are successfully mated at the ages of 18 to 24 months. The average age for all cases is 37·5 months.

   (*c*) The same information is not available for Free State conditions, but it appears that the most prolific ewes can be successfully bred between the ages of 18 to 24 months.

3. The life period of lambing is influenced greatly by the age at which the first successful mating occurs. When the first reproduction occurs at the normal age (23 to 29 months), the average life period of lambing of prolific ewes is approximately 8 years, but when the first lambing is postponed, the average is reduced by approximately 3 years.

When the first reproduction occurs at the normal age (23 to 29 months), the life period of lambing of 50 to 80 per cent. of prolific ewes is 8 to 10 years.

When the first reproduction is postponed, the life period of lambing is approximately 5 years, and approximately 50 per cent. of cases have a life period of lambing between 4 and 6 years.

4. The number of lambs produced is influenced greatly, but not entirely, by the life period of lambing. During a normal life period of lambing of prolific ewes, approximately 67 per cent. of ewes produce 9 to 14 lambs, the average being approximately 9 lambs.

In cases in which the first lambing is postponed, 63 per cent. of the ewes produce only 4 and 5 lambs, and the average production of all ewes is 5·2 lambs.

5. The fecundity of the ewes is reflected in the number of sets of twins produced.

In the cases in which reproduction commences at the normal age, twins are produced by 60 and 67 per cent. of the ewes, and the total number of sets of twins produced in approximately 40.

In the case in which the first lambing is postponed, 43 per cent. of the ewes produce twins, and the total number of sets of twins produced is 17.

6. The presence of non-lambing years reflects inconsistency in breeding, but when a large number of individuals is considered, a certain number of unproductive years appears to be permissible.

Considering the total life periods of lambing years of the two more highly productive studs, A and C, the non-lambing years amount to 3·1 and 4·8 per cent. respectively; the equivalent figure in the less productive Stud B, is 13·7 per cent.

7. Under Karroo conditions, prolific Merino stud ewes experience normal ovulation and oestrus as soon as 12 to 60 days after parturition, while in other instances this period is found to range between 111 and 134 days. Such short periods of sexual rest permit an easy conversion of the lambing season from autumn to spring and *vice versa*.

Further, evidence indicates that after longer periods of sexual rest, there appears to be no definite tendency for prolific ewes under Karroo conditions to adhere to any one particular time of the year or season for lambing.

8. It must be emphasized that the above analysis was made from the records of the most prolific ewes in the three stud registers, and that the average fertility of the studs is very likely to be somewhat lower than that reflected by this analysis.

Recommendations.—1. The infertility of maiden ewes reflected in the results of the analysis of the records of three Merino studs is marked.

The control or hand service method of mating maiden ewes is preferable to the small paddock system of mating, in that the former method reveals the cases in which sexual activity is absent and in which fertility has not been established by mating. Hence, controlled serving clearly indicates the need for the extension of the serving period in order to obtain a maximum number of successful matings.

When mating is undertaken in the spring, every endeavour should be made to autumn mate ewes which did not exhibit oestrus during the spring, or which were not fertilised during the spring mating.

The need for setting the generative organs of young sheep in motion appears to be of such great importance, that it may prove advantageous to extend the mating periods over seveiel months and to tolerate the disadvantages of awkward periods of lambing.

2. The breeding histories of the most prolific ewes in three Merino studs have been examined. The postponement of the breeding of maiden Merino ewes decreases the life period of lambing and reduces fertility and fecundity. Every endeavour should be made to obtain normal growth and to establish fertility by mating maiden ewes between the ages of 18 to 24 months. Recommendations for accomplishing this have been made in the above section.

The occurrence of non-lambing years means direct economic loss. Non-lambing years result in reduced material from which selection for improvement is to be made. This latter aspect is of particular importance in the progress of breeding in South Africa, where the studs are comparatively small and consequently selection is limited. Many factors may bring about infertility; the proper management of mating operations appears to be of considerable importance. However, the subject is of too great length to be dealt with fully here; the precautions necessary to ensure fertility were mentioned recently in a general discussion by Roux and Hoffman (1935).

As fertility has a genetic basis, selection for the character will bring about increased fertility. Mr. P. D. Rose (1935) in private correspondece with the author, drew attention to the greater need for attention to the milking qualities of ewes during the selection of breeding stock. The establishment of higher milking qualities would permit greater concentration upon selection for fecundity.

B. The Breeding Habits of Sheep in Various Parts of South Africa.

A certain amount of information relative to the breeding habits of sheep in South Africa has become available at a few centres where researches upon the sex physiology of sheep have been conducted. Only recently, experiments in sex physiology have been organized to study the peculiarities of various breeds of sheep and such differences as may result due to altered physiographical conditions. A small portion of this work has been reported in this thesis. (Experiments 6 and 7).

Küpfer (1928) states that, while sheep in Central Europe experience continuous annual sexual activity, Merino and Woolled Persian sheep in South Africa (western Free State) have a prolonged inactive or anoestrous period during the spring and summer months, thus limiting the period during which reproduction is possible.

Quinlan and Maré's (1931) observations on Merino sheep under Cape (Karroo) conditions, do not agree with those of Küpfer. The former authors state that, provided conditions (rainfall and pasture) are favourable, Merinos under South African conditions experience a continuous series of dioestrous cycles throughout the year.

The observations reported by the author in this thesis agree to a very great extent with the results of Küpfer (1928).

With the exception of the results reported by Küpfer (1928) on Woolled Persian sheep and those presented in this thesis on various crossbred sheep, no controlled observations upon the sexual activity of breeds other than the Merino have been recorded in South Africa.

The British breeds of sheep, in their home country and in other countries in the northern hemisphere, experience restricted annual sexual activity; the inactive sexual period, or anoestrum, occurs during the spring and summer months (Heape, 1900; Marshall 1903, 1922; Marshall and Hammond, 1925; Roberts, 1921; Cole and Miller, 1933; Grant, 1934).

Although, apparently, no controlled observations were made by Quinlan and Maré (1931), they are of the opinion that the acclimatisation of certain mutton breeds of sheep (Suffolk, Romney Marsh, Corriedale, Dorset Horn, and Wensleydale) takes about six months; the environmental change from Europe to South Africa is said to result in temporary sexual inactivity.

In order to obtain a general impression of the practical problems of sex physiology in sheep confronting stud breeders, a questionaire was circulated to many breeders of various breeds of sheep in the four provinces of the Union. Since failure to reproduce is due, in the great majority of cases, to the absence of sexual activity of the females, and the marked absence of breeding at times when mating is usually attempted (autumn and spring) is likely to be noticed by stud owners, the observations of stud breeders should yield some general information upon the breeding habits of their breeds of sheep. The main purpose of the questionaire was to ascertain, whether breeders had observed restricted or unrestricted season or seasons during which sheep would breed or mate. It is gratifying to note that many breeders replied to the questionaire, and that there appeared to be no hesitation in giving opinions based upon their experiences.

The non-woolled breeds such as the Blackhead Persian, Afrikander, and Karakul are restricted almost entirely to the semi-arid areas of the Union.

Blackhead Persian ewes reach sexual maturity at the age of 6 months, which is earlier than Merinos under similar conditions. It is considered that non-pregnant ewes of this breed may be bred at any time of the year; hence sexual activity is continuous throughout the year. It is possible to obtain two lambings in three years from this breed.

The Ronderib Afrikander reaches sexual maturity at 5 months and the ewes may be bred during the spring and autumn months.

Karakuls mate readily during the spring months and it is said that spring lambs are difficult to obtain. However, it is contended that two lambings a year are possible when the young lambs are slaughtered for pelts.

A limited number of studs of Corriedales and a few of the British breeds are found in the four provinces.

Suffolks have been found to have a restricted lambing season, which is said to extend, in the Transvaal, from July to September, and in the Cape, from July to November. Maiden ewes can be mated at the age of 18 months. An interesting case is reported in which imported ewes were landed in South Africa during November; they lambed the following April and May, and again in December of the same year; since then for many years, autumn lambing has been attempted without success. In another case, imported ewes were in this country for one year before they lambed and lambing occurred in the spring.

Southdowns have been experienced to have a restricted lambing season under Cape (Karroo) conditions; this season may extend from July to November. Maiden ewes may be bred successfully at the age of 18 months.

Oxfords in the western Transvaal can be bred to lamb in the autumn and spring. It is said that maiden ewes can be mated at 12 months of age.

Romney Marsh sheep have a restricted lambing season which occurs in the spring under Cape conditions. Maiden ewes can be mated successfully at the age of 18 months.

Dorset Horn sheep can be mated to lamb during the autumn months under Karroo conditions. No evidence of spring lambing in this breed is available.

Corriedales in the Transvaal have a restricted breeding season; lambs are born in the spring. A small stud of Corriedales is kept at the Ermelo Research Station, and it has not been possible to lamb down earlier than July. However, it has been reported that in Natal, Corriedales lamb in the autumn and spring seasons.

Merino breeders generally maintain that autumn lambing is more satisfactory in that such lambs do not receive the set back to which spring-born lambs are subject, because of internal parasitic infection. While many farmers mate only in the spring for autumn lambs, a large number obtain both autumn and spring born lambs; the practice is adopted in all four provinces. This would indicate the existence of two mating and, hence, two sexual seasons in Merinos under various South African conditions. It is important to note that, in cases where both autumn and spring lambs are obtained, it has been reported from some of the best sheep areas of the Cape (Karroo) and the Free State, that spring-born lambs are more easy to obtain than autumn-born lambs. This would indicate that, under those conditions, a larger number of ewes exhibit heat during the autumn than the spring, or that a larger percentage of ewes mated during the former season are fertilized. A certain number of breeders actually reported sexual inactivity of the ewes during the spring months.

Various explanations are given by breeders for the delayed sexual activity of Merino ewes. The greater percentage consider that rainfall is the determining factor; droughts delay the breeding season and ewes are said to come on heat about 14 days after the first good rains. Others can find no reason for the great variations in early and late mating seasons observed by them, and the failure of "dry" ewes to take the ram during certain seasons when it is desired to undertake mating operations.

Discussion.

It appears that the extreme degree of polyoestrum is a breed characteristic of some of the non-woolled breeds of sheep, especially the Blackhead Persian. While it is considered definite that the latter breed is capable of lambing at any time of the year under Cape (Karroo) conditions, it is not known whether continuous sexual activity would be maintained under different physiographical conditions.

Most British breeds of sheep when transferred to South Africa maintain their breed characteristic of restricted seasonal sexual activity, but they alter the rhythm with respect to the calendar months or, in other words, their sexual activity conforms to the new order of the seasons. It appears highly probable that the time taken for the conversion will depend upon the season during which the animals are introduced into the new environment, but it is suspected that the conversion is rapid.

The Dorset Horn, which is known to have two sexual seasons in other countries (Roberts, 1921; Marshall, 1922), apparently experiences similar activity under South African (Karroo) conditions.

With regard to the Merino, the bulk of evidence indicates that great variation exists. The extreme degree of polyoestrum has been observed under experimentation to exist under Cape (Karroo) conditions (Quinlan and Maré, 1931). No doubt, under such conditions, autumn and spring lambs are equally easy to obtain. The extreme polyoestrous condition apparently is a Merino characteristic. However, evidence indicates that the characteristic is not given full expression in all areas of the country. Whether, and to what degree, variations in the sexual activity of Merino sheep are influenced by climatic and nutritional conditions, will remain obscure until the problem is solved by strictly controlled experimentation.

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APPENDIX 1A.

EXPERIMENT 1A.

TABLES I–VIII: WEIGHTS OF SHEEP IN POUNDS.

TABLE I.

Group I.

Sheep No.	1932.												1933.																																	
	22.7.	5.8.	20.8.	3.9.	14.9.	29.9.	13.10.	26.10.	10.11.	24.11.	8.12.	21.12.	4.1.	18.1.	1.2.	15.2.	2.3.3	17.3.	30.3.	13.4.	27.4.	10.5.	25.5.	8.6.	22.6.	6.7.	21.7.	4.8.	17.8.	31.8.	15.9.	28.9.	12.10.	26.10.	8.11.	24.11.	8.12.	22.12.	5.1.
29252....	65·0	65·5	65·0	66·5	68·5	68·0	71·0	68·5	58·5	62·5	61·5	61·5	61·0	60·0	63·5	63·0	65·0	66·0	66·5	67·5	63·5	64·5	67·0	70·0	66·0	67·5	70·5	71·0	66·0	71·5	71·5	73·0	73·0	72·5	74·5	71·5	66·5	64·0	61·5
29270....	67·0	72·0	67·5	70·0	67·0	69·7	72·0	71·5	59·0	63·0	64·0	63·0	61·5	61·0	62·5	64·0	64·0	68·5	58·5	68·5	69·5	66·0	67·0	73·5	68·0	72·0	71·0	74·0	68·0	66·0	67·0	72·5	66·0	69·0	68·5	64·0	60·0	58·0	53·5
29324....	64·5	65·0	68·0	68·5	71·5	71·0	73·0	73·0	64·5	65·5	69·5	68·5	69·0	69·0	73·0	72·5	74·0	77·5	73·5	77·5	78·5	75·5	79·0	79·0	76·5	79·5	80·5	81·0	81·5	82·0	79·0	82·0	82·0	84·5	84·5	79·5	72·0	71·5	66·5
29325....	61·5	68·5	66·0	65·0	71·5	70·5	74·5	73·5	61·5	62·5	70·5	60·5	66·5	68·0	70·5	71·0	70·0	74·5	70·5	75·5	75·0	75·0	77·5	78·5	79·5	81·0	77·0	82·5	76·0	81·0	78·0	85·0	83·0	80·5	82·5	81·5	73·0	71·0	66·5
29328....	55·0	57·5	57·0	56·5	60·5	60·5	63·5	60·0	49·5	50·0	55·0	56·0	5415	52·0	56·0	55·5	56·5	58·5	54·5	59·0	58·0	58·5	61·5	63·0	59·5	60·0	57·5	59·5	63·5	61·0	60·0	61·0	61·5	65·0	62·0	57·0	54·0	52·0	47·0
29340....	73·5	76·0	71·5	73·5	76·5	78·0	81·0	77·0	66·5	72·5	72·0	72·5	74·0	71·0	74·5	76·0	78·0	73·0	74·0	80·5	78·5	74·0	82·5	82·5	81·5	85·0	83·5	86·0	84·5	85·0	76·5	76·5	69·0	74·5	78·5	79·0	74·0	70·0	69·5	64·5
29805....	64·0	68·0	70·0	70·0	73·0	73·0	71·0	73·5	65·5	68·0	71·5	70·5	70·5	70·0	74·0	73·5	76·5	79·0	78·5	80·0	79·5	78·5	80·5	83·0	81·5	83·0	84·5	83·5	87·0	80·5	83·0	85·0	84·0	86·0	86·0	81·5	74·5	73·0	69·5
29815....	50·0	53·5	50·5	51·0	53·5	52·5	54·0	54·0	47·0	47·5	52·0	51 0	50·5	52·5	55·5	56·5	57·5	58·5	60·0	61·5	62·5	5·95	61·0	63·5	62·5	63·0	63·0	63·0	64·0	64·0	61·5	63·0	63·5	64·0	62·0	58·0	52·5	49·5	51·5
32476....	59·5	61·0	58·5	58·5	60·5	59·0	62·0	60·5	51·0	53·5	59·0	57·0	58·5	54·5	58·5	58·5	58·5	60·5	60·5	60·5	60·5	58·5	64·5	65·0	65·5	67·0	67·0	67·5	65·0	70·5	67·0	69·5	64·5	69·0	70·0	65·0	59·0	56·5	56·0
32491....	54·5	58·0	58·0	58·5	62·0	62·0	64·0	64·5	54·0	55·0	59·0	58·5	57·5	57·5	61·5	61·0	61·5	62·5	64·5	65·5	65·5	65·5	67·5	66·5	66·5	69·0	69·0	68·5	66·5	70·5	70·0	74·0	72·0	73·5	71·5	70·0	62·0	60·5	58·5
Total.....	614·5	645·0	631·5	638·0	664·5	663·5	686·0	676·0	577·0	600·0	634·0	629·0	623·5	615·5	649·5	651·5	661·5	678·5	661·0	696·0	691·0	675·5	708·0	724·5	707·0	727·0	723·5	736·5	722·0	732·0	713·5	734·0	724·0	742·5	740·5	702·0	643·5	625·5	595·0
Average..	61·4	64·5	63·2	63·8	66·4	66·4	68·6	67·6	57·7	60·0	63·4	62·9	62·4	61·6	65·0	65·2	66·2	67·8	66·1	69·6	69·1	67·6	70·8	72·4	70·7	72·7	72·4	73·6	72·2	73·2	71·4	73·4	72·4	74·2	74·0	70·2	64·4	62·6	59·5

TABLE II.

Group II.

35508....	62·5	64·0	61·0	66·5	62·5	64·5	63·5	65·0	56·0	60·0	61·0	61·0	63·5	60·5	62·0	63·5	64·5	63·0	62·0	67·0	66·5	67·5	69·5	72·0	68·0	71·5	72·0	73·0	70·5	72·5	71·5	75·5	72·5	74·5	75·0	68·6	63·0	63·0	62·0
35509....	71·0	79·5	77·5	83·0	78·5	82·0	86·0	86·5	73·0	79·0	79·0	80·5	78·0	78·0	79·5	80·5	83·0	81·5	82·5	83·5	88·0	86·5	90·5	88·0	84·5	88·5	88·0	90·5	89·5	91·5	92·5	93·5	92·5	95·5	94·5	89·5	82·0	79·0	77·0
29274....	65·0	67·0	62·5	67·5	61·0	64·5	62·5	64·5	54·5	58·0	58·5	59·5	60·0	57·5	62·5	60·5	63·0	65·0	61·0	65·0	66·0	65·5	67·5	68·5	67·0	69·0	72·0	70·0	68·0	71·0	65·5	70·0	71·0	69·5	71·0	69·0	61·5	62·0	58·0
29279....	65·0	74·5	68·5	74·0	69·5	71·5	71·0	75·0	60·5	67·0	70·0	70·0	70·0	65·5	69·0	68·5	68·5	68·5	68·5	71·5	65·0	69·5	68·0	66·0	65·5	67·5	65·5	68·5	65·0	67·0	66·5	70·0	68·5	69·0	70·0	69·5	60·0	60·0	57·5
29335....	50·5	54·5	52·0	57·5	53·0	57·5	58·0	59·0	48·0	53·5	53·5	55·5	53·5	52·0	54·0	52·0	56·0	55·0	55·5	57·0	56·0	54·5	57·5	56·5	57·5	57·5	56·0	57·0	57·0	57·0	56·0	54·5	53·0	56·5	56·5	56·0	47·0	46·0	44·0
29341....	69·0	75·6	72·5	82·0	73·0	78·0	78·0	80·5	64·0	67·5	68·5	69·0	69·5	68·5	69·0	69·0	72·0	74·0	73·0	72·0	74·0	73·5	75·0	73·0	72·5	76·5	73·5	78·0	71·0	7·54	65·5	74·5	74·0	76·0	77·0	73·0	62·5	65·0	61·5
29793....	55·5	63·5	60·0	62·0	57·0	61·0	62·0	62·5	51·5	54·5	55·0	56·0	56·5	53·5	56·5	56·0	58·5	60·5	57·5	60·0	61·0	62·0	66·0	67·0	65·0	68·0	68·0	69·5	67·5	68·5	69·5	69·0	69·0	71·0	72·5	66·5	59·0	59·0	55·0
29827....	63·5	64·0	60·0	68·0	67·5	70·5	73·5	69·0	65·0	69·0	62·0	69·0	71·0	70·0	70·0	71·5	73·0	71·0	65·5	75·0	71·5	77·0	76·5	76·5	80·0	74·0	81·5	82·0	71·5	79·0	74·5	80·5	79·0	77·0	78·0	75·5	69·5	66 5	67·0
32480....	55·0	58·5	54·0	60·0	55·5	61·5	61·5	63·5	50·5	56·5	57·0	58·0	59·5	56·0	59·0	59·0	60·0	60·5	57·5	64·5	64·0	65·0	65·5	67·5	66·5	71·0	68·5	70·5	70·0	73·0	71·5	74·0	72·5	74·0	72·5	71·5	63·5	61·5	58·5
32493....	57·5	59·0	56·5	60·5	58·0	61·0	63·5	66·5	55·0	60·5	60·0	61·5	61·5	59·0	61·5	63·0	66·0	64·5	63·5	69·5	69·5	69·0	71·0	72·0	71·0	74·0	71·0	73·5	72·0	74·5	76·5	78·0	76·0	75·5	78·0	73·5	63·0	63·0	61·0
Total.....	614·0	661·0	624·5	681·0	635·5	672·0	679·5	692·0	577·5	625·5	624·5	640·0	643·0	620·5	643·0	643·5	664·5	663·5	646·5	685·0	681·5	690·0	707·0	707·0	697·5	717·5	716·0	732·5	702·0	728·5	709·5	739·5	728·0	738·5	745·0	712·0	631·0	625·0	601·5
Average..	61·4	66·1	62·4	68·1	63·6	67·2	68·0	69·2	57·8	62·6	62·4	64·0	64·3	62·0	64·3	64·4	66·4	66·4	64·6	68·5	68·2	69·0	70·7	70·7	69·8	71·8	71·6	73·2	70·2	72·8	71·0	74·0	72·8	73·8	74·5	71·2	63·1	62·5	60·2

APPENDIX 1A.

EXPERIMENT 1A.

TABLES I–VIII: WEIGHTS OF SHEEP IN POUNDS.

Group I.

1934.																																					1935.
4.8.	17.8.	31.8.	15.9.	28.9.	12.10.	26.10.	8.11.	24.11.	8.12.	22.12.	5.1.	19.1.	1.2.	16.2.	2.3.	16.3.	29.3.	13.4.	26.4.	12.5.	29.5.	9.6.	23.6.	7.7.	21.7.	4.8.	18.8.	31.8.	15.9.	29.9.	13.10.	27.10.	10.11.	24.11.	8.12.	22.12.	4.1.
71·0	66·0	71·5	71·5	73·0	73·0	72·5	74·5	71·5	66·5	64·0	61·5	57·5	63·5	61·5	62·0	64·0	67·0	66·5	64·5	66·5	67·0	72·0	72·0	70·5	72·0	74·0	73·5	76·5	73·5	76·0	77·5	76·5	Slaug	htered	1.11.3	4.	
74·0	68·0	66·0	67·0	72·5	66·0	69·0	68·5	64·0	60·0	58·0	53·5	50·5	51·0	48·5	46·5	51·0	55·0	56·0	56·0	56·5	59·5	59·0	57·5	59·0	62·0	60·6	Slaug	htered	15.8.3	4.						
81·0	81·5	82·0	79·0	82·0	82·0	84·5	84·5	79·5	72·0	71·5	66·5	63·5	68·5	68·0	66·0	71·5	75·0	74·0	70·5	75·0	75·5	77·0	80·0	79·5	81·5	82·0	81·0	80·5	83·5	84·0	85·0	84·0	76·0	76·0	71·0	76·0	74·0
82·5	76·0	81·0	78·0	85·0	83·0	80·5	82·5	81·5	73·0	71·0	66·5	63·0	68·0	67·5	67·0	71·0	72·0	67·0	63·5	61·0	61·0	66·5	67·0	67·0	68·5	61·5	57·0	55·5	58·5	61·0	63·5	58·5	56·5	54·0	61·0	Slaug	hterrd 4.1.35.
59·5	63·5	61·0	60·0	61·0	61·5	65·0	62·0	57·0	54·0	52·0	47·0	45·5	51·0	49·0	49·0	53·0	54·0	53·5	51·0	51·5	52·5	56·0	53·0	53·0	55·5	57·0	55·5	58·0	Slaug	htered	7.9.34.						
86·0	84·5	85·0	76·5	69·0	74·5	78·5	79·0	74·0	70·0	69·5	64·5	61·5	71·5	69·5	67·5	72·5	76·0	74·0	72·5	76·0	72·5	73·5	75·0	77·0	82·0	80·5	79·5	82·5	Slaug	htered	7.9.34.						
83·5	87·0	80·5	83·0	85·0	84·0	86·0	86·0	81·5	74·5	73·0	69·5	64·5	72·5	69·5	69·0	70·5	71·0	74·5	74·5	76·0	74·0	75·0	77·5	78·0	78·5	76·0	76·0	79·0	74·5	74·5	76·0	74·0	68·0	67·5	58·0	64·5	Slaughtered 28.12.35.
63·0	64·0	64·0	61·5	63·0	63·5	64·0	62·0	58·0	52·5	49·5	51·5	46·5	52·5	48·0	47·5	49·0	52·0	51·5	51·0	51·0	47·5	52·5	52·5	51·5	53·0	52·0	46·0	51·0	48·5	Slaug	htered	27.9.34.					
67·5	65·0	70·5	67·0	69·5	64·5	69·0	70·0	65·0	59·0	56·5	56·0	51·5	56·5	56·5	55·0	58·5	61·5	61·5	58·5	62·0	60·5	63·5	64·0	64·5	66·5	67·0	64·5	70·0	64·0	Slaug	htered	22.9.34.					
68·5	66·5	70·5	70·0	74·0	72·0	73·5	71·5	70·0	62·0	60·5	58·5	54·0	48·5	58·0	57·5	60·0	62·5	62·0	61·5	61·0	59·5	66·5	67·0	66·5	68·0	69·5	69·0	69·0	67·5	70·0	67·5	71·5	61·5	64·0	60·0	63·0	Slaughtered 4.1.35.
736·5	722·0	732·0	713·5	734·0	724·0	742·5	740·5	702·0	643·5	625·5	595·0	558·0	613·5	596·0	587·0	621·0	646·0	640·5	623·5	636·6	629·5	661·5	665·5	666·5	687·0	686·5	606·5	623·5	606·0	363·0	367·0	369·5	264·0	264·0	243·0	264·5	74·0
73·6	72·2	73·2	71·4	73·4	72·4	74·2	74·0	70·2	64·4	62·6	59·5	55·8	61·4	59·6	58·7	62·1	64·6	64·0	62·4	63·6	63·0	66·2	66·6	66·6	68·7	68·6	67·4	69·3	67·3	72·6	73·4	73·9	66·0	66·0	60 7	66·1	74·0

Group II.

73·0	70·5	72·5	71·5	75·5	72·5	74·5	75·0	68·6	63·0	63·0	62·0	57·5	61·0	58·5	56·0	60·0	64·5	64·0	62·5	65·0	63·0	66·5	63·0	64·5	69·0	70·0	69·5	71·0	68·0	69·5	65·0	65·5	Slaug	htered	1.11.3	4.	
90·5	89·5	91·5	92·5	93·5	92·5	95·5	94·5	89·5	82·0	79·0	77·0	70·0	70·5	72·5	70·5	76·5	81·0	81·5	78·5	80·5	75·0	82·0	80·5	80·0	81·0	79·5	76·5	78·0	77·0	77·0	Slaug	htered	12.10.	34.			
70·0	68·0	71·0	65·5	70·0	71·0	69·5	71·0	69·0	61·5	62·0	58·0	57·5	57·0	57·0	57·0	57·0	63·0	64·0	63·0	66·0	62·0	64·0	67·5	68·5	68·0	66·0	66·5	70·0	64·5	68·5	Slaug	htered	12.10.	34.			
68·5	65·0	67·0	66·5	70·0	68·5	69·0	70·0	69·5	60·0	60·0	57·5	54·5	57·0	55·5	55·5	57·0	61·0	57·0	53·0	55·0	60·0	59·0	56·0	57·5	63·0	65·0	Slaug	htered	15.8.3	4.							
57·0	57·0	57·0	56·0	54·5	53·0	56·5	56·5	56·0	47·0	46·0	44·0	42·0	45·5	43·5	42·5	47·0	49·0	48·5	48·0	47·5	47·0	49·5	51·0	50·5	50·5	47·5	46·0	46·0	44·0	44·0	44·5	45·5	45·5	44·5	44·0	Slaug	htered 21.12.34.
78·0	71·0	7·54	65·5	74·5	74·0	76·0	77·0	73·0	62·5	65·0	61·5	58·5	61·5	60·5	61·0	61·0	66·0	68·0	65·0	67·0	58·0	64·0	66·0	64·0	67·0	69·0	66·5	68·5	65·5	68·5	70·5	71·0	66·5	67·5	64·0	66·5	Slaughtered 28.12.34.
69·5	67·5	68·5	69·5	69·0	69·0	71·0	72·5	66·5	59·0	59·0	55·0	51·5	54·5	55·0	51·5	55·5	57·5	59·5	60·5	62·0	57·0	63·0	63·5	60·0	63·5	59·0	59·0	60·5	58·0	58·0	59·5	60·0	55·0	52·5	51·5	54·0	Slaughtered 28.12.34.
82·0	71·5	79·0	74·5	80·5	79·0	77·0	78·0	75·5	69·5	66 5	67·0	62·0	63·5	62·0	62·5	68·0	69·0	68·5	66·0	69·0	70·0	73·0	75·0	72·0	76·0	74·5	75·0	71·5	72·5	72·0	70·5	74·5	69·5	68·5	64·0	72·5	Slaughtered 28.12.34.
70·5	70·0	73·0	71·5	74·0	72·5	74·0	72·5	71·5	63·5	61·5	58·5	54·0	59·5	58·0	56·0	59·0	65·0	63·5	62·5	65·0	65·0	70·0	69·5	71·5	71·5	72·5	69·0	71·5	69·0	69·5	67·0	70·5	62·0	61·5	58·0	Slaug	htered 21.12.34.
73·5	72·0	74·5	76·5	78·0	76·0	75·5	78·0	73·5	63·0	63·0	61·0	56·5	60·0	59·5	62·0	64·0	70·0	69·5	70·0	71·0	71·0	73·0	74·5	77·0	77·5	79·5	78·0	79·0	80·0	81·5	78·0	80·0	75·0	74·5	71·0	Slaug	htered 21.12.34.
732·5	702·0	728·5	709·5	739·5	728·0	738·5	745·0	712·0	631·0	625·0	601·5	564·0	590·0	582·0	574·5	605·5	646·0	644·0	629·0	648·0	628·0	664·0	666·5	665·5	687·0	682·5	606·0	616·0	598·0	608·5	455·5	467 0	373·5	369 0	352·5	193·0	
73·2	70·2	72·8	71·0	74·0	72·8	73·8	74·5	71·2	63·1	62·5	60·2	56·4	59·0	58·2	57·4	60·6	64·6	64·4	62·9	64·8	62·8	66·4	66·6	66·6	68·7	68·2	67·3	68·4	65·5	67·6	65·0	66·7	62·2	61·5	58·7	64·3	

APPENDIX 1A.

WEIGHTS OF SHEEP IN POUNDS—(*continued*).

TABLE III. — *Group III.*

Sheep No.	1932.												1933.																							
	22.7.	5.8.	20.8.	3.9.	14.9.	29.9.	13.10.	26.10.	10.11.	24.11.	8.12.	21.12.	4.1.	18.1.	1.2.	15.2.	2.3.	17.3.	30.3.	13.4.	27.4.	10.5.	25.5.	8.6.	22.6.	6.7.	21.7.	4.8.	17.8.	31.8.	15.9.	28.9.	12.10.	26.10.	8.11.	24.11.	8.12.	22.12.
35499....	65·0	69·5	67·5	70·0	68·5	69·5	71·0	70·0	57·0	63·0	63·0	63·5	64·0	64·5	63·5	61·0	63·5	66·0	67·5	67·5	68·0	67·5	67·0	70·5	68·0	71·5	69·5	69·5	70·0	71·0	70·0	70·5	71·0	73·5	72·0	68·0	63·0	63·0
35498....	65·0	69·5	68·5	74·0	72·5	71·5	76·0	74·0	64·5	69·5	71·0	73·0	74·0	75·0	73·5	69·5	72·5	72·5	71·5	75·5	74·5	73·0	75·0	74·5	74·5	78·0	74·5	73·5	73·5	74·0	74·0	77·5	74·5	75·5	75·0	72·5	66·5	63·5
29258....	70·5	76·0	73·0	79·0	76·5	76·5	80·0	81·5	70·0	75·5	74·5	77·5	74·5	79·5	78·5	77·5	81·5	83·5	82·0	84·0	82·5	85·0	83·5	85·0	84·0	90·0	89·0	85·5	86·5	90·0	89·5	91·5	89·0	88·5	90·0	89·0	82·0	78·5
29265....	50·5	58·0	53·0	57·5	57·5	57·5	58·0	57·5	50·5	56·5	56·0	57·5	57·5	60·5	60·0	58·5	59·5	61·5	61·5	64·0	63·0	64·0	63·5	63·0	61·5	64·5	63·0	62·0	63·0	63·0	64·0	65·0	66·0	68·0	68·0	66·0	62·0	61·0
29273....	68·0	70·0	69·5	75·0	73·0	72·0	77·0	77·0	60·0	67·0	68·0	70·5	72·0	71·0	70·0	66·5	69·0	70·5	72·5	74·5	74·0	74·0	74·5	77·0	74·5	78·5	76·5	78·0	77·5	73·5	72·5	74·0	71·5	74·5	74·5	71·0	64·0	59·0
29283....	62·5	69·5	69·0	73·0	71·0	69·5	73·5	75·0	64·0	69·0	68·0	69·5	69 0	71·5	68·5	70·5	72·0	74·0	75·0	76·5	77·5	76·5	77·0	80·0	79·5	83·0	75·5	80·0	78·0	81·0	77·0	80·0	79·5	84·0	82·0	81·5	74·0	69·5
29330....	63·5	68·0	68·0	72·0	70·0	71·5	74·0	72·5	60·0	Died	22.11.32.																											
29334....	55·5	60·5	55·0	61·5	60·5	56·5	61·5	62·5	50·5	54·5	55·0	56·5	56·5	57·5	59·5	57·0	60·0	64·0	64·5	67·0	65·0	67·0	66·0	67·0	64·5	67·5	66·5	67·5	63·5	68·0	66·5	68·5	68·0	69·0	66·5	65·0	59·5	56·5
32482....	56·0	55·0	51·0	58·5	59·0	57·5	60·5	60·5	51·5	56·5	55·5	58·0	57·5	58·5	58·5	57·5	57·5	58·5	58·5	60·0	60·5	60·5	61·5	65·0	62·0	67·0	63·5	66·0	66·0	67·5	67·5	67·5	65·0	66·5	62·5	62·5	57·5	54·5
32495....	56·0	56·5	59·5	63·0	61·5	63·0	65·5	67·5	55·5	58·0	62·5	65·5	65·5	68·0	69·5	69·0	71·5	72·0	73·5	75·5	77·0	77·5	78·5	80·5	78·0	82·0	82·5	84·0	88·0	89·0	90·0	91·0	89·5	91·5	88·0	88·5	73·5	73·0
Total.....	612·5	652·5	634·0	683·5	670·0	665·0	697·0	698·0	583·5	569·5	573·5	591·5	590·5	607·0	601·5	587·0	607·0	622·5	626·5	644·5	642·0	645·0	646·5	662·5	646·5	682·0	660·5	666·0	666·0	677·0	671·0	685·5	674·0	691·0	678·5	664·0	602·0	578·5
Average..	61·2	65·2	63·4	68·4	67·0	66·5	69·7	69·8	58·4	63·3	63·7	65·7	65·6	67·4	66·8	65·2	67·4	69·2	69·6	71·6	71·3	71·8	71·8	73·6	71·8	75·8	73·4	74·0	74·0	75·2	74·6	76·2	74·9	76·8	75·4	73·4	66·6	64·3

TABLE IV. — *Group IV.*

29261....	60·0	64·5	60·0	67·5	67·0	66·0	65·5	68·5	57·5	60·5	57·0	60·5	62·0	62·5	62·5	62·5	64·0	64·0	64·0	62·0	61·0	61·5	62·5	62·5	60·0	64·0	64·0	63·5	61·5	60·5	61·5	64·5	63·0	63·5	61·0	59·5	50·5	52·0
29268....	64·5	66·0	65·5	70·5	70·5	70·0	71·5	71·5	66·0	65·5	62·5	64·0	66·5	67·0	64·5	64·5	67·5	66·0	67·0	66·0	63·5	68·0	71·0	69·5	68·5	71·5	68·0	68·0	70·0	72·0	72·5	68·0	68·5	70·5	68·0	64·0	62·5	59·5
29298....	73·0	74·5	72·0	76·0	77·5	79·0	80·0	79·5	68·0	73·5	69·0	73·0	75·0	74·5	74·0	74·0	73·0	74·0	76·5	74·0	73·5	73·0	75·5	74·0	73·0	78·0	76·0	72·0	73·0	76·0	74·5	75·0	75·5	75·5	74·0	69·5	67·0	66·0
29306....	60·5	65·0	57·5	65·5	58·0	65·0	67·5	66·0	56·5	60·5	55·0	60·0	63·5	63·5	65·5	64·0	64·0	63·5	65·0	64·5	63·0	65·5	64·0	69·0	66·5	67·5	63·0	63·0	58·5	64·5	59·5	63·5	64·0	68·5	61·5	57·0	55·5	53·0
29309....	74·0	79·0	73·0	79·0	79·0	77·5	77·5	79·0	68·5	69·5	68·0	69·5	68·0	69·0	65·5	66·0	67·5	68·5	70·0	67·0	68·0	69·5	69·5	72·5	67·5	71·0	71·5	70·0	62·0	67·0	68·5	66·0	65·0	70·5	67·5	63·5	62·0	61·5
29316....	65·5	68·0	65·0	69·0	69·5	70·5	73·5	72·5	62·5	65·5	61·0	65·5	68·5	70·5	70·5	69·5	71·0	71·0	74·0	71·5	71·5	71·5	71·5	73·5	71·5	76·6	74·0	75·5	70·5	70·0	71·5	73·0	73·0	74·0	73·0	70·0	65·5	65·0
29822....	65·5	63·5	60·0	61·5	64·0	62·5	62·0	65·5	55·5	60·0	56·0	59·0	60·0	60·5	60·0	60·0	61·5	61·5	63·0	59·5	59·0	57·5	57·5	60·0	57·5	60·5	56·0	58·5	57·5	55·5	56·5	53·5	54·5	54·5	54·5	51·0	49·0	48·5
29825....	67·5	69·0	63·0	68·0	58·0	67·5	69·5	70·5	60·5	65·5	62·5	65·0	65·0	68·0	67·0	67·5	69·5	66·5	68·0	68·5	66·0	66·0	68·0	69·0	69·0	71·5	70·5	67·5	68·0	68·5	67·0	68·5	68·5	67·5	67·5	64·0	60·0	58·5
29830....	61·0	65·0	63·0	66·5	66·5	66·5	66·0	66·0	56·5	56·5	54·0	56·0	58·5	54·5	54·0	53·0	55·5	56·5	57·5	57·0	56·0	54·0	53·5	57·0	55·5	57·5	56·5	56·0	56·5	57·0	55·0	55·5	55·5	57·0	58·0	55·0	50·5	46·0
35500....	64·0	70·5	70·0	72·0	71·0	72·5	73·0	74·0	66·0	69·5	64·0	69·0	71·5	69·5	71·5	69·0	71·5	73·0	75·0	73·5	72·5	72·5	74·5	75·5	71·0	75·5	72·5	78·0	68·0	68·0	68·0	67·5	64·0	67·0	64·5	61·0	56·5	58·0
Total.....	655·5	685·0	649·0	695·5	681·0	697·0	706·0	713·0	617·5	646·5	609·0	641·5	658·5	659·5	655·0	650·0	665·0	664·5	680·0	663·5	654·0	659·0	667·5	682·5	660·0	693·5	672·0	667·0	645·5	659·0	654·5	655·0	650·5	669·5	649·5	614·5	579·0	568·0
Average..	65·6	68·5	64·9	69·6	68·1	69·7	70·6	71·3	61·8	64·6	60·9	64·1	65·9	66·0	65·5	65·0	66·5	66·4	68·0	66·4	65·4	65·9	66·0	68·2	66·0	69·4	67·2	66·7	64·6	65·9	65·4	65·5	65·0	67·0	65·0	61·4	57·9	56·8

TABLE V. — *Group V.*

35507....	72·0	72·5	68·5	74·0	71·5	74·5	70·5	72·5	61·0	77·0	67·0	66·0	64·5	65·5	67·5	61·5	62·0	63·5	62·0	62·5	60·5	60·0	58·5	59·5	60·0	61·5	58·5	59·5	59·0	60·5	56·5	57·5	54·0	54·0	52·5	51·0	46·0	45·5
35506....	85·5	85·0	82·5	88·0	85·0	85·5	85·5	83·0	71·5	79·0	77·5	79·5	73·5	79·0	78·0	77·5	76·5	79·0	80·0	79·0	77·0	77·5	79·5	80·5	82·0	79·5	78·5	78·0	78·0	81·5	78·5	83·0	80·5	79·5	80·5	79·0	71·5	69·5
35505....	87·0	85·5	84·5	88·5	81·5	89·5	88·0	88·0	75·5	74·0	81·0	77·0	82·0	83·0	84·0	82·5	85·5	86·0	80·5	88·0	85·0	86·5	84·5	86·0	88·5	87·5	85·5	88·0	81·5	76·5	74·5	70·0	67·5	63·5	61·5	58·5	Died 1	3.12.33
13367....	66·5	67·5	63·0	67·5	64·5	62·5	64·5	63·5	50·5	58·0	58·5	56·0	58·5	55·5	56·0	56·0	58·0	56·5	56·5	66·5	56·5	59·0	54·0	57·5	56·0	56·5	55·5	54·0	54·0	54·0	50·0	55·0	50·0	53·5	Sick.	Die	d 29.1	2.33.
15329....	85·0	88·0	85·0	82·0	79·5	83·0	84·0	81·0	69·0	77·5	78·0	75·5	79·5	78·0	80·5	79·5	81·0	79·5	75·5	78·5	81·0	79·5	78·5	81·5	80·0	83·5	81·0	84·5	82·5	82·5	81·5	86·0	81·0	83·5	81·0	80·5	74·5	73·0
21658....	84·0	83·5	84·0	84·5	81·5	84·5	85·0	87·5	80·0	80·5	83·0	85·5	83·0	86·0	89·0	87·5	88·0	90·5	89·0	92·5	92·5	92·5	94·0	95·5	94·5	94·0	96·5	96·5	98·5	101·0	102·5	103·5	98·5	102·5	103·0	100·0	92·5	92·5
25876....	83·5	87·5	78·0	85·5	81·0	82·5	78·0	82·0	68·0	74·0	73·0	74·0	75·0	74·5	78·0	77·5	75·5	78·5	78·5	78·0	77·0	76·5	70·5	75·0	78·0	76·0	76·5	79·5	74·0	71·5	74·5	80·0	72·5	71·5	75·0	74·5	67·5	66·5
25882....	84·5	83·5	81·0	83·0	83·0	83·5	85·0	85·5	75·0	77·0	79·0	80·0	78·5	82·0	79·0	Sick.		Died	22.4.33.																			
25883....	88·0	87·0	81·0	83·0	78·5	83·5	82·5	84·5	71·0	78·5	77·0	79·5	81·0	77·5	79·0	81·0	82·0	83·0	75·0	82·5	80·5	80·5	79·0	85·5	80·0	86·0	85·0	87·0	84·5	87·5	83·5	91·0	88·5	90·5	83·5	85·5	81·0	75·0
25907....	68·5	70·0	69·0	69·5	68·5	69·5	71·5	70·0	61·0	64·0	65·0	63·5	64·0	65·5	66·0	62·0	67·0	66·5	68·5	70·0	67·5	69·5	69·0	71·5	70·5	71·5	69·5	70·0	73·0	75·0	70·5	74·0	70·0	71·0	70·0	68·5	63·0	59·0
Total.....	804·5	810·0	774·5	805·5	774·5	798·5	794·5	797·5	682·5	739·5	739·0	736·5	739·5	746·5	757·0	665·0	675·5	683·0	665·5	697·5	677·5	687·5	667·5	692·5	689·5	696·0	686·5	697·0	685·0	690·5	672·0	700·0	662·5	669·5	607·0	597·5	496·0	481·0
Average..	80·4	81·0	77·4	80·6	77·4	79·8	79·4	79·8	68·2	74·0	73·9	73·6	74·0	74·6	75·7	73·9	75·1	75·9	73·9	77·5	75·3	75·5	74·2	76·9	76·5	77·3	76·3	77·4	76·1	76·6	74·7	77·8	73·6	74·4	75·9	74·7	70·9	68·7

WEIGHTS OF SHEEP IN POUNDS—(*continued*).

Group III.

1934.																																								
21.7.	4.8.	17.8.	31.8.	15.9.	28.9.	12.10.	26.10.	8.11.	24.11.	8.12.	22.12.	5.1.	19.1.	1.2.	16.2.	2.3.	16.3.	29.3.	13.4.	26.4.	12.5.	29.5.	9.6.	23.6.	7.7.	21.7.	4.8.	18.8.	31.8.	15.9.	29.9.	13.10.	27.10.	10.11.	24.11.	8.12.				
69·5	69·5	70·0	71·0	70·0	70·5	71·0	73·5	72·0	68·0	63·0	63·0	64·5	61·0	64·5	61·5	60·5	65·0	67·0	65·5	67·0	66·0	66·5	71·5	66·0	66·0	67·5	69·5	68·0	66·5	Slaughtered 7.9.34.										
74·5	73·5	73·5	74·0	74·0	77·5	74·5	75·5	75·0	72·5	66·5	63·5	62·0	60·5	60·0	58·5	58·0	58·5	60·0	59·0	60·0	61·0	60·0	64·0	59·0	56·0	59·5	61·5	57·0	Slaughtered	23.8.34.										
89·0	85·5	86·5	90·0	89·5	91·5	89·0	88·5	90·0	89·0	82·0	78·5	79·5	80·0	81·5	79·0	80·0	80·0	80·0	76·5	77·5	80·0	78·5	83·5	84·0	82·0	83·0	86·5	85·5	85·5	84·5	88·5	89·5	89·0	Slaughtered	1.11.34.					
63·0	62·0	63·0	63·0	64·0	65·0	66·0	68·0	68·0	66·0	62·0	61·0	59·5	59·0	62·0	60·0	60·0	62·5	65·0	65·0	64·0	65·0	61·5	62·5	63·5	63·0	63·5	65·0	64·5	64·0	64·0	66·5	Slaughtered	12.10.34.							
76·5	78·0	77·5	73·5	72·5	74·0	71·5	74·5	74·5	71·0	64·0	59·0	56·5	59·5	61·5	56·5	56·5	59·0	66·0	63·0	61·5	64·5	61·0	70·5	64·5	63·5	66·5	68·5	65·0	66·0	Slaughtered	14.9.34.									
75·5	80·0	78·0	81·0	77·0	80·0	79·5	84·0	82·0	81·5	74·0	69·5	69·0	68·0	67·5	67·0	66·0	70·5	73·5	73·0	71·5	69·0	72·0	76·0	77·0	73·5	72·5	77·0	75·5	75·0	Slaughtered	7.9.34.									
66·5	67·5	63·5	68·0	66·5	68·5	68·0	69·0	66·5	65·0	59·5	56·5	54·5	50·0	56·0	54·0	53·0	56·0	57·0	57·0	57·0	60·0	53·5	58·0	57·5	55·5	55·0	56·5	56·0	58·0	57·5	Slaughtered	22.9.34.									
63·5	66·0	66·0	67·5	67·5	67·5	65·0	66·5	62·5	62·5	57·5	54·5	53·5	53·5	57·0	54·5	55·5	55·0	59·5	58·0	59·5	61·0	61·5	64·5	63·5	62·5	65·0	66·0	64·5	68·0	66·0	66·0	68·0	68·0	Slaughtered	1.11.34.					
82·5	84·0	88·0	89·0	90·0	91·0	89·5	91·5	88·0	88·5	73·5	73·0	72·0	67·0	74·0	70·5	68·0	73·0	77·5	76·0	79·0	82·5	79·5	85·5	85·5	87·0	87·5	87·5	88·0	87·5	88·0	88·5	88·5	88·0	Slaughtered	27.10.34.					
660·5	666·0	666·0	677·0	671·0	685·5	674·0	691·0	678·5	664·0	602·0	578·5	571·0	558·5	584·0	561·5	557·5	579·5	605·5	593·0	597·0	609·0	594·0	636·0	620·5	609·0	620·0	638·0	624·0	570·5	501·5	309·5	246·0	245·0							
73·4	74·0	74·0	75·2	74·6	76·2	74·9	76·8	75·4	73·4	66·6	64·3	63·4	62·0	64·9	62·4	61·9	64·4	67·3	65·9	66·5	67·7	66·0	70·7	68·9	67·7	68·9	70·9	69·3	71·3	71·6	77·4	82·0	81·7							

Group IV.

64·0	63·5	61·5	60·5	61·5	64·5	63·0	63·5	61·0	59·5	50·5	52·0	47·0	45·5	49·0	45·0	46·0	47·5	48·0	48·5	48·5	48·0	48·0	50·5	50·0	50·0	55·0	52·5	52·5	Slaughtered	30.8.34.										
68·0	68·0	70·0	72·0	72·5	68·0	68·5	70·5	68·0	64·0	62·5	59·5	58·0	52·5	56·0	54·5	55·0	60·0	62·0	63·0	59·5	62·5	58·0	62·5	57·5	62·0	65·0	63·0	61·5	63·0	58·5	62·5	Slaughtered	4.10.34.							
76·0	72·0	73·0	76·0	74·5	75·0	75·5	75·5	74·0	69·5	67·0	66·0	62·0	58·0	61·5	59·0	61·0	63·5	66·0	68·0	67·0	67·5	66·5	66·5	65·0	64·0	68·5	65·0	62·0	66·0	66·0	68·5	Slaughtered	4.10.34.							
63·0	63·0	58·5	64·5	59·5	63·5	64·0	68·5	61·5	57·0	55·5	53·0	54·5	48·0	55·5	50·0	53·0	55·5	58·5	56·5	56·0	55·5	53·0	59·0	55·5	58·5	62·5	61·5	58·5	65·0	60·5	60·5	Slaughtered	4.10.34							
71·5	70·0	62·0	67·0	68·5	66·0	65·0	70·5	67·5	63·5	62·0	61·5	54·0	53·0	59·0	53·5	55·0	61·0	63·0	58·0	63·0	63·5	58·0	62·0	57·5	61·0	64·5	60·5	58·5	64·0	59·0	Slaughtered	27.9.34.								
74·0	75·5	70·5	70·0	71·5	73·0	73·0	74·0	73·0	70·0	65·5	65·0	59·0	58·5	62·0	58·5	61·0	67·0	67·0	65·0	65·5	66·0	68·5	70·5	69·5	67·0	72·5	70·5	68·0	69·5	69·0	Slaughtered	22.9.34.								
56·0	58·5	57·5	55·5	56·5	53·5	54·5	54·5	54·5	51·0	49·0	48·5	48·0	44·5	49·5	45·0	47·0	50·0	51·0	52·5	51·5	53·5	55·0	57·0	53·5	56·0	56·5	50·5	48·5	Slaughtered	30.8.34.										
70·5	67·5	68·0	68·5	67·0	68·5	68·5	67·5	67·5	64·0	60·0	58·5	58·0	52·5	58·5	53·5	57·0	57·5	61·0	58·0	60·0	61·5	61·0	63·0	62·5	62·5	61·0	62·5	58·5	64·0	Slaughtered	14.9.34.										
56·5	56·0	56·5	57·0	55·0	55·5	55·5	57·0	58·0	55·0	50·5	46·0	45·0	Died	16.1.34.																												
72·5	78·0	68·0	68·0	68·0	67·5	64·0	67·0	64·5	61·0	56·5	58·0	53·5	51·0	56·0	55·0	56·0	60·0	62·0	62·0	63·5	62·0	63·5	66·0	64·5	65·0	67·5	64·0	65·0	Slaughtered	30.8.34.										
672·0	667·0	645·5	659·0	654·5	655·0	650·5	669·5	649·5	614·5	579·0	568·0	539·0	462·5	507·0	474·0	491·0	572·0	538·5	531·5	534·5	540·0	531·5	557·0	535·5	546·0	573·0	550·0	533·0	391·5	313·0	191·5									
67·2	66·7	64·6	65·9	65·4	65·5	65·0	67·0	65·0	61·4	57·9	56·8	53·9	51·4	56·3	52·7	54·6	63·6	59·8	59·0	59·8	60·0	59·1	61·9	59·5	60·7	63·7	61·1	59·2	65·2	62·6	63·8									

Group V.

58·5	59·5	59·0	60·5	56·5	57·5	54·0	54·0	52·5	51·0	46·0	45·5	49·5	48·5	53·0	50·0	48·5	50·5	54·5	51·5	51·0	51·0	52·0	55·0	53·5	52·0	54·0	52·5	52·0	Slaughtered	23.8.34.										
78·5	78·0	78·0	81·5	78·5	83·0	80·5	79·5	80·5	79·0	71·5	69·5	65·5	66·0	69·0	63·5	64·0	69·0	70·5	70·0	71·5	70·5	65·5	69·0	69·5	66·5	70·5	70·0	71·5	69·5	71·0	68·5	69·5	71·0	61·5	61·0	58·0	Slaughtered	14.12.34.		
85·5	88·0	81·5	76·5	74·5	70·0	67·5	63·5	61·5	58·5	Died	13.12.33.																													
55·5	54·0	54·0	54·0	50·0	55·0	50·0	53·5	Sick.	Died	29.12.33.																														
81·0	84·5	82·5	82·5	81·5	86·0	81·0	83·5	81·0	80·5	74·5	73·0	73·5	71·0	71·0	70·0	69·0	69·5	72·0	71·0	69·0	70·0	69·5	75·0	72·0	71·5	70·0	72·0	70·0	Slaughtered	23.8.34.										
96·5	96·5	98·5	101·0	102·5	103·5	98·5	102·5	103·0	100·0	92·5	92·5	88·5	89·5	90·5	89·0	85·0	88·0	89·5	89·5	89·0	91·5	93·0	93·0	95·0	95·0	96·0	94·5	96·5	93·0	90·5	90·0	90·0	94·5	85·5	86·0	Slaughtered	7.12.34.			
76·5	79·5	74·0	71·5	74·5	80·0	72·5	71·5	75·0	74·5	67·5	66·5	63·5	62·5	69·0	60·0	69·0	63·0	64·0	68·5	68·0	63·0	60·5	68·0	62·0	62·5	64·0	58·0	58·0	60·5	58·0	60·5	56·0	59·5	57·0	57·0	56·5	Slaughtered	14.12.34.		
85·0	87·0	84·5	87·5	83·5	91·0	88·5	90·5	83·5	85·5	81·0	75·0	75·5	74·0	76·0	72·0	70·0	69·5	69·0	65·5	66·5	65·5	63·5	71·5	65·0	55·0	57·0	62·0	56·0	55·5	55·5	Slaughtered	22.9.34.									
69·5	70·0	73·0	75·0	70·5	74·0	70·0	71·0	70·0	68·5	63·0	59·0	60·0	58·5	62·0	57·5	59·5	60·0	63·0	62·5	59·0	58·0	59·0	65·5	61·5	61·5	63·5	63·0	64·0	62·0	63·5	61·5	60·5	54·0	51·5	50·5	Slaughtered	30.11.34.			
686·5	697·0	685·0	690·5	672·0	700·0	662·5	669·5	607·0	597·5	496·0	481·0	476·0	470·0	489·5	462·5	465·0	469·5	482·5	478·5	474·0	469·5	483·0	497·0	478·5	464·0	475·0	472·0	468·0	340·5	338·5	280·5	276·0	279·0	255·5	254·5	114·5				
76·3	77·4	76·1	76·6	74·7	77·8	73·6	74·4	75·9	74·7	70·9	68·7	68·0	67·1	69·9	66·1	66·4	67·1	68·9	68·4	69·0	67·0	67·1	71·0	68·4	66·3	67·8	67·4	66·9	68·1	67·7	70·1	69·0	69·8	63·8	63·6	57·2				

APPENDIX 1A. TABLE VI. *Group VI.*

Sheep No.	1932.						1933.																													
	13.10.	26.10.	10.11.	24.11.	8.12.	21.12.	4.1.	18.1.	1.2.	15.2.	2.3.	17.3.	30.3.	13.4.	27.4.	10.5.	25.5.	8.6.	23.6.	6.7.	21.7.	4.8.	17.8.	31.8.	15.9.	28.9.	12.10.	26.10.	8.11.	24.11.	8.12.	22.12.	5.1.	19.1.	1.2.
15257....	73·0	75·5	72·0	75·5	73·5	77·0	74·5	76·0	79·5	80·5	82·5	81·0	78·5	82·0	79·5	80·5	77·5	78·0	75·5	73·5	67·5	68·0	66·0	67·5	66·5	69·0	65·5	73·0	75·0	74·5	70·0	74·5	82·0	78·0	80·5
15327....	81·0	83·5	78·5	80·0	81·5	84·5	85·0	85·0	88·5	86·5	90·0	88·0	87·5	87·0	85·5	85·5	85·0	83·0	81·0	79·0	70·5	73·0	71·5	68·5	65·5	71·0	72·0	70·5	74·0	69·5	70·5	76·0	74·0	76·0	78·0
21504....	60·0	64·0	62·0	67·0	66·0	69·5	69·0	67·5	71·0	70·5	72·5	69·0	71·0	71·0	68·5	66·5	66·0	63·0	61·5	57·0	57·5	54·5	49·5	49·0	50·5	54·5	55·5	58·0	60·5	61·5	56·5	63·0	64·5	57·5	64·5
21607....	59·5	63·5	59·0	58·0	63·5	62·0	64·5	65·0	69·0	67·0	70·0	70·0	73·0	69·5	68·0	66·0	65·5	66·5	63·0	57·0	57·5	54·5	55·0	53·0	54·5	61·5	Killed	by do	gs 29.9	.33.					
24928....	67·5	70·5	65·0	69·5	69·0	70·5	68·0	71·5	72·5	74·0	73·0	73·0	74·5	74·5	73·0	74·0	73·5	75·0	70·5	66·0	62·5	64·0	59·5	56·5	62·0	64·5	67·5	70·5	73·5	71·0	67·5	71·5	74·0	73·5	76·0
25873....	77·0	82·0	78·0	81·0	81·5	84·5	81·0	83·0	87·5	85·5	87·5	88·0	91·0	88·5	86·5	86·5	85·0	87·0	82·5	81·0	75·5	74·5	71·5	72·0	73·0	76·5	78·0	79·5	85·0	84·0	79·5	84·0	86·5	86·0	88·0
35501....	64·5	71·5	63·5	70·5	72·0	71·5	71·0	74·0	79·5	76·0	74·5	73·5	80·0	75·5	76·0	77·0	76·0	78·0	72·0	73·0	67·5	61·0	64·0	65·5	62·5	68·5	67·0	72·0	79·5	74·0	73·0	76·0	80·5	81·0	84·5
35496....	64·5	69·0	68·0	67·5	72·0	77·0	75·0	77·0	82·5	82·0	85·5	86·5	89·0	87·0	86·0	85·5	84·5	81·5	80·0	76·0	74·5	71·5	68·0	68·5	72·5	75·0	75·0	81·0	85·0	87·0	83·0	92·5	95·0	95·0	101·0
35502....	74·0	77·5	68·5	74·5	72·5	76·0	77·5	78·0	80·5	79·0	83·0	82·5	83·5	83·0	82·5	77·5	76·5	73·0	73·5	67·0	63·0	59·5	61·0	61·0	63·5	68·5	62·5	71·5	74·0	70·0	68·0	69·0	66·5	71·5	77·0
35497....	79·0	83·0	79·5	83·0	85·5	89·0	87·5	87·5	93·5	92·5	95·5	95·5	94·0	94·0	93·0	93·0	92·0	91·0	86·5	82·0	78·5	74·0	72·0	71·5	73·5	81·5	84·5	90·5	95·5	99·0	90·0	92·0	100·0	99·5	105·0
Total....	697·0	740·0	694·0	727·5	737·0	761·5	753·0	764·5	804·0	793·5	814·0	807·0	822·0	812·0	798·5	792·0	771·5	776·0	746·0	711·5	674·5	654·5	638·0	633·0	644·0	690·5	627·5	666·5	702·0	690·5	658·0	698·5	723·0	718·0	754·5
Average..	69·7	74·0	69·4	72·8	73·7	76·2	75·3	76·4	80·4	79·4	81·4	80·7	82·2	81·2	79·8	79·2	77·2	77·6	74·6	71·2	67·4	65·4	63·8	63·3	64·4	69·0	69·7	74·1	78·0	76·7	73·1	77·6	80·0	79·8	83·8

TABLE VII. *Group VII.*

15351....	74·5	77·5	76·0	82·0	82·0	81·5	80·5	82·0	90·0	87·0	90·0	89·0	89·5	89·5	89·0	87·5	87·5	87·5	86·5	85·5	83·5	78·0	78·0	79·5	83·5	86·0	90·0	90·0	89·5	92·0	87·5	90·5	94·0	91·5	95·5
15921....	73·0	75·0	72·5	78·0	81·0	81·5	80·5	80·0	87·0	85·0	87·0	84·5	88·0	86·0	86·5	88·0	86·5	90·0	89·5	87·0	87·0	82·0	81·5	84·0	84·5	90·5	93·0	93·5	98·0	94·5	83·5	88·0	90·5	87·5	89·5
22210....	66·5	69·5	66·5	65·5	63·5	69·0	67·0	67·5	75·0	72·5	74·5	74·5	81·5	76·5	79·0	79·0	79·0	83·0	81·0	82·0	78·5	81·0	75·0	78·5	76·5	78·5	80·0	80·5	85·0	85·5	74·5	79·5	82·0	80·5	84·5
22547....	63·0	68·0	65·5	68·0	72·0	74·0	72·0	71·5	79·5	75·0	76·0	79·0	84·0	80·5	78·0	78·5	80·0	79·5	79·5	78·0	75·0	75·0	77·0	77·0	79·5	84·0	87·0	89·5	91·5	89·5	85·0	87·5	89·5	88·0	92·5
24955....	72·0	81·0	71·5	77·5	75·0	80·0	77·0	77·0	84·0	82·5	85·0	85·5	88·5	85·0	85·0	85·0	89·0	89·0	90·5	90·0	90·0	88·0	87·5	87·0	88·0	94·0	94·5	97·5	99·0	101·5	91·5	93·5	96·0	95·5	97·5
25105....	61·0	67·5	61·5	66·0	68·5	70·5	68·5	68·5	76·0	74·0	75·5	76·5	74·0	78·5	76·0	75·5	78·0	76·5	77·0	76·0	75·0	73·0	74·0	74·5	76·5	83·0	85·0	88·0	91·0	91·0	83·5	84·5	89·5	89·0	91·5
25908....	62·0	66·5	63·5	69·0	70·5	73·5	73·0	75·0	79·0	80·0	80·0	82·0	84·5	80·5	81·0	81·5	79·0	81·5	79·0	77·0	78·0	76·5	76·0	76·5	79·5	82·0	84·0	84·5	87·5	87·5	80·0	85·5	84·5	83·5	86·0
25938....	64·5	72·0	66·0	69·0	70·0	72·0	69·0	70·5	78·5	76·0	77·5	76·0	81·5	79·0	78·5	80·5	77·5	80·5	78·5	78·5	75·0	72·5	72·0	71·0	70·5	76·5	79·5	80·0	82·0	81·0	73·5	77·7	78·0	78·0	80·0
35503....	72·0	76·5	74·5	76·0	76·0	80·5	76·5	79·5	83·0	83·5	82·0	86·0	85·5	89·5	87·5	89·5	92·0	94·5	91·0	89·5	89·0	91·0	90·5	92·5	92·0	96·5	97·0	97·0	102·0	103·0	94·0	96·5	99·5	99·5	102·5
35504....	90·0	95·5	91·5	94·0	96·0	96·5	95·0	95·5	102·0	99·5	101·5	102·0	105·0	100·5	101·5	101·5	101·5	104·5	103·0	102·5	97·5	99·5	98·0	102·5	102·0	107·0	107·0	109·0	114·0	114·0	101·5	104·5	105·5	103·0	108·5
Total....	698·5	749·0	709·0	745·0	754·5	799·0	759·0	767·0	834·0	815·0	829·0	835·0	862·0	845·5	841·0	846·5	850·0	866·5	855·5	846·0	828·5	816·5	809·5	823·0	832·5	878·0	887·0	909·5	939·5	939·5	853·5	887·5	909·0	896·0	928·0
Average..	69·8	74·9	70·9	74·5	75·4	79·9	75·9	76·7	83·4	81·5	82·9	83·5	86·2	84·6	84·1	84·6	85·0	86·6	85·6	84·6	82·8	81·6	81·0	82·3	83·2	87·8	88·7	91·0	94·0	94·0	85·4	88·8	90·9	89·6	92·8

TABLE VIII. *Group VIII.*

Sheep No.	1933.																																		
	10.5.	25.5.	8.6.	23.6.	6.7.	21.7.	4.8.	17.8.	31.8.	15.9.	28.9.	12.10.	26.10.	8.11.	24.11.	8.12.	22.12.	5.1.	19.1.	1.2.	16.2.	2.3.	16.3.	29.3.	14.4.	28.4.	12.5.	29
21500....	87·0	88·0	87·5	86·5	84·5	86·5	82·5	80·0	80·5	79·5	85·5	85·5	84·0	87·5	88·5	78·5	83·0	86·5	82·5	87·0	86·5	91·5	91·5	85·5	84·5	89·0	86·0	84
22059....	91·0	82·0	83·0	89·0	78·5	79·5	76·0	75·5	72·5	76·0	80·0	79·5	81·0	85·0	87·5	82·0	85·5	88·0	87·0	89·0	89·5	90·5	92·0	90·0	88·5	88·0	86·5	87
25025....	92·0	90·0	92·0	90·0	89·0	89·5	84·5	79·0	81·0	85·5	86·0	88·0	90·0	95·5	98·0	84·5	90·5	93·5	95·5	97·0	98·5	97·5	98·0	96·0	98·0	97·0	96·5	94
25948....	84·5	84·5	85·5	83·5	83·5	86·0	82·0	78·0	77·5	77·5	81·5	80·5	82·5	88·5	86·5	81·0	84·0	87·0	86·5	88·5	87·0	90·0	89·5	89·0	91·0	88·5	87·5	86
35708....	78·5	75·6	77·0	75·0	74·5	69·0	70·0	67·0	67·0	72·5	75·5	77·0	78·5	84·5	78·0	76·0	80·0	83·0	82·0	86·0	83·5	85·5	84·0	83·0	84·0	85·0	80·5	75
35732....	71·5	73·5	71·0	69·0	68·0	68·0	67·5	63·0	61·5	66·5	70·0	67·0	73·5	75·0	74·0	67·0	69·0	71·5	72·0	72·0	71·0	—	63·5	65·0	68·0	67·5	65·5	67
35994....	91·0	89·0	94·5	90·0	88·5	88·0	84·0	80·0	80·5	84·5	90·0	89·0	90·5	96·0	98·0	92·0	95·0	96·5	97·0	101·0	99·5	—	92·5	92·0	92·0	90·5	89·5	87
37058....	86·5	85·5	84·0	85·0	82·0	78·0	78·5	75·5	75·0	82·0	85·0	85·0	88·0	92·5	92·5	86·0	89·5	91·0	87·0	95·0	90·5	85·5	83·5	84·0	83·5	82·0	78·0	76
37059....	82·0	88·5	90·0	80·5	88·5	86·5	84·5	81·0	82·0	85·5	84·0	88·5	90·0	89·5	94·5	84·0	90·0	93·0	93·5	94·5	96·5	97·5	99·0	98·0	95·5	98·0	95·5	93
37061....	92·5	92·0	90·5	77·5	83·0	83·5	82·0	79·5	79·0	85·0	91·5	90·5	98·5	97·5	99·5	91·5	97·5	103·5	102·5	103·5	100·0	105·5	106·0	100·0	107·0	105·0	99·0	94
Total....	856·5	849·5	855·0	826·0	820·0	814·5	791·5	758·5	756·5	794·5	829·0	830·5	856·5	891·5	897·0	822·0	864·0	893·5	885·5	913·5	902·5	743·5	899·5	882·5	892·0	890·5	864·5	844
Average..	85·6	85·0	85·5	82·6	82·0	81·4	79·2	75·8	75·6	79·4	82·9	83·0	85·6	89·2	89·7	82·2	86·4	89·4	88·6	91·4	90·2	92·9	90·0	88·2	89·2	89·0	86·4	84

1934.																														1935.	
2.10.	26.10.	8.11.	24.11.	8.12.	22.12.	5.1.	19.1.	1.2.	16.2.	2.3.	16.3.	29.3.	13.4.	26.4.	12.5.	29.5.	9.6.	23.6.	7.7.	21.7.	4.8.	18.8.	31.8.	15.9.	29.9.	13.10.	27.10.	10.11.	24.11.	8.12.	22.12.	4.1.	
5·5	73·0	75·0	74·5	70·0	74·5	82·0	78·0	80·5	81·0	83·5	86·0	83·0	85·5	81·5	81·0	79·5	79·0	75·0	73·0	69·0	62·5	64·0	67·5	72·0	77·0	78·0	81·5	Slaug	htered	9.11.34.			
2·0	70·5	74·0	69·5	70·5	76·0	74·0	76·0	78·0	78·0	81·0	82·5	81·0	81·0	78·5	80·5	78·5	78·0	75·0	68·0	68·0	64·5	64·5	64·5	67·5	68·5	64·0	72·5	60·0	70·5	67·5	69·5	69·5	Slaughtered 11.1.35.
5·5	58·0	60·5	61·5	56·5	63·0	64·5	57·5	64·5	66·0	66·0	66·0	69·5	70·5	70·0	66·5	67·5	67·0	62·0	59·5	58·5	51·5	51·5	53·5	66·5	58·0	58·0	60·5	54·0	59·0	61·0	60·5	61·5	Slaughtered 11.1.35.
illed	by do	gs 29.9	.33.																														
7·5	70·5	73·5	71·0	67·5	71·5	74·0	73·5	76·0	77·0	79·5	82·5	82·0	85·0	81·5	80·0	79·5	79·5	73·0	73·0	67·0	64·0	62·5	66·0	72·0	75·5	71·0	77·0	71·0	Slaug	htered	22.11.	34.	
8·0	79·5	85·0	84·0	79·5	84·0	86·5	86·0	88·0	88·0	89·0	91·0	88·0	91·5	91·0	89·0	88·5	90·0	85·0	83·5	79·5	72·5	71·0	77·0	81·0	84·0	83·0	83·5	73·5	80·5	80·0	82·5	83·0	Slaughtered 11.1.35.
7·0	72·0	79·5	74·0	73·0	76·0	80·5	81·0	84·5	80·5	85·5	88·0	83·0	84·5	87·5	83·5	82·5	86·0	81·0	76·5	66·0	63·0	64·0	69·0	73·0	77·0	75·0	85·0	75·0	82·0	81·5	Slaug	htered	14.12.34.
5·0	81·0	85·0	87·0	83·0	92·5	95·0	95·0	101·0	101·5	104·5	105·0	100·0	101·5	101·5	98·5	96·5	97·0	90·0	84·5	80·0	74·0	75·5	80·0	84·5	88·5	89·5	88·5	83·0	87·5	Slaug	htered	30.11.34.	
2·5	71·5	74·0	70·0	68·0	69·0	66·5	71·5	77·0	78·0	79·0	81·0	75·0	78·5	78·5	73·5	71·0	72·0	69·5	63·0	59·0	56·0	56·0	62·0	63·0	68·0	65·0	72·0	64·0	68·0	65·5	71·5	76·0	Slaughtered 11.1.35.
4·5	90·5	95·5	99·0	90·0	92·0	100·0	99·5	105·0	102·5	105·5	105·0	105·5	106·5	100·0	94·0	94·5	92·5	86·5	83·5	77·5	74·5	74·0	77·0	82·5	91·0	89·5	90·5	85·5	91·0	Slaug	htered	30.11.34.	
7·5	666·5	702·0	690·5	658·0	698·5	723·0	718·0	754·5	752·5	773·5	787·0	767·0	784·5	770·0	746·5	738·0	741·0	697·0	664·5	624·5	582·5	583·0	616·5	662·0	687·5	673·0	711·0	566·0	538·5	355·5	284·0	290·0	
9·7	74·1	78·0	76·7	73·1	77·6	80·0	79·8	83·8	83·6	86·0	87·4	85·2	87·2	86·2	83·3	82·0	82·3	77·4	73·8	69·4	64·7	64·8	68·5	73·6	76·4	74·9	79·0	70·7	76·9	71·1	71·0	72·5	

Group VII.

0·0	90·0	89·5	92·0	87·5	90·5	94·0	91·5	95·5	93·5	94·0	92·0	89·0	93·0	89·5	87·5	88·0	85·0	85·0	84·0	82·0	80·0	76·5	75·5	83·5	83·5	85·5	88·0	83·0	85·5	Slaug	htered	30.11.34.	
3·0	93·5	98·0	94·5	83·5	88·0	90·5	87·5	89·5	91·0	90·5	92·5	89·0	90·5	90·0	89·5	85·5	87·5	87·5	84·0	83·0	79·0	79·5	79·5	85·5	89·0	89·0	91·0	81·0	85·0	85·0	86·0	85·0	
0·0	80·5	85·0	85·5	74·5	79·5	82·0	80·5	84·5	85·0	83·0	86·0	82·5	85·0	85·5	84·0	84·5	88·0	81·0	81·0	76·0	77·0	76·0	77·5	80·5	83·0	84·0	81·5	75·0	Slaug	htered	16.11.	34.	
7·0	89·5	91·5	89·5	85·0	87·5	89·5	88·0	92·5	92·5	95·5	93·0	91·0	91·0	91·0	91·5	90·5	92·0	90·0	87·5	85·0	80·5	82·5	85·0	88·0	89·5	90·0	91·0	81·0	83·0	84·0	84·0	82·5	
4·5	97·5	99·0	101·5	91·5	93·5	96·0	95·5	97·5	98·5	96·0	98·0	93·0	96·5	95·5	97·0	97·0	93·5	92·5	92·0	91·0	88·0	90·5	90·5	96·0	99·5	99·0	100·5	90·0	93·0	94·5	95·0	91·5	
5·0	88·0	91·0	91·0	83·5	84·5	89·5	89·0	91·5	91·5	92·0	92·0	90·0	90·0	90·5	90·5	87·0	87·5	83·5	85·5	82·0	82·0	83·5	87·0	90·5	94·5	96·0	95·5	91·0	93·5	Slaug	htered	7.12.34.	
4·0	84·5	87·5	87·5	80·0	85·5	84·5	83·5	86·0	85·5	87·5	88·0	86·0	84·5	87·0	84·5	83·5	87·5	82·5	81·5	79·5	77·0	81·5	80·5	83·0	83·5	83·5	82·5	72·5	80·0	83·5	Slaug	htered	14.12.34.
9·5	80·0	82·0	81·0	73·5	77·7	78·0	78·0	80·0	78·5	79·0	80·0	80·0	76·5	79·0	77·5	79·0	77·5	76·0	72·5	70·0	67·0	64·0	67·5	Slaug	htered	14.9.3	4.						
7·0	97·0	102·0	103·0	94·0	96·5	99·5	99·5	102·5	105·5	103·0	102·0	102·0	102·0	101·5	100·0	100·5	102·0	97·5	96·0	89·0	91·0	95·5	96·0	103·0	104·0	104·0	104·0	98·5	Slaug	htered	22.11.	34.	
7·0	109·0	114·0	114·0	101·5	104·5	105·5	103·0	108·5	106·5	108·0	106·0	105·0	108·0	106·5	104·5	102·0	103·5	101·0	100·0	98·5	95 5	97·0	102·5	103·5	106·0	106·5	109·0	Slaug	htered	9.11.3	4.		
7·0	909·5	939·5	939·5	853·5	887·5	909·0	896·0	928·0	928·0	928·0	929·5	907·5	917·0	916 0	906·5	897·5	904·0	876·5	864·0	836·0	817·0	826·5	841·5	813·5	832·5	837·5	843·0	672·0	520·0	347·0	265·0	259·0	
7·7	91·0	94·0	94·0	85·4	88·8	90·9	89·6	92·8	92·8	92·8	93·0	90·8	91·7	91·6	90·6	89·8	90·4	87·6	86·4	83·6	81·7	82·6	84·2	90·4	92·5	93·1	93·7	84·0	86·6	86·7	88·3	86·3	

Group VIII.

1934.																								1935.	
1.2.	16.2.	2.3.	16.3.	29.3.	14.4.	28.4.	12.5.	29.5.	9.6.	23.6.	7.7.	21.7.	4.8.	18.8.	31.8.	15.9.	29.9.	13.10.	27.10.	10.11.	24.11.	8.12.	22.12.	4.1.	
87·0	86·5	91·5	91·5	85·5	84·5	89·0	86·0	84·5	85·5	80·5	84·5	84·5	91·5	93·0	94·0	91·5	96·0	96·5	95·5	Slaug	htered	9.11.3	4.		
89·0	89·5	90·5	92·0	90·0	88·5	88·0	86·5	87·0	82·0	80·5	82·5	80·5	86·5	88·5	88·5	90·5	91·5	88·0	92·0	81·0	86·5	88·0	Slaug	htered	14.12.34.
97·0	98·5	97·5	98·0	96·0	98·0	97·0	96·5	94·0	90·5	87·0	90·5	87·0	95·0	96·0	97·0	99·0	98·5	97·5	99·5	91·0	96·5	96·5	Slaug	htered	21.12.34.
88·5	87·0	90·0	89·5	89·0	91·0	88·5	87·5	86·0	82·5	82·0	84·5	84·0	82·0	83·5	84·5	84·5	89·0	87·0	88·5	79·5	84·0	87·5	87·0	85·0	
86·0	83·5	85·5	84·0	83·0	84·0	85·0	80·5	75·0	80·5	72·0	71·5	75·5	76·5	80·5	82·5	83·0	89·5	84·0	87·0	79·0	Slaug	htered	22.11.	34.	
72·0	71·0	—	63·5	65·0	68·0	67·5	65·5	67·0	64·0	64·0	66·5	64·0	69·0	70·0	75·0	79·0	82·5	84·5	84·5	74·5	Slaug	htered	16.11.	34.	
101·0	99·5	—	92·5	92·0	92·0	90·5	89·5	87·0	87·5	81·5	90·0	90·5	97·0	99·5	101·5	100·5	107·5	105·0	107·0	95·5	98·0	Slaug	htered	7.12.34.	
95·0	90·5	85·5	83·5	84·0	83·5	82·0	78·0	76·5	76·0	68·0	75·0	79·0	81·0	83·5	82·5	84·5	87·0	88·0	86·0	79·0	83·0	87·0	89·0	Slaughtered 4.1.35.	
94·5	96·5	97·5	99·0	98·0	95·5	98·0	95·5	93·5	92·0	89·0	88·0	90·5	94·5	95·5	99·0	101·0	100·5	99·5	101·5	Slaug	htered	9.11.3	4.		
103·5	100·0	105·5	106·0	100·0	107·0	105·0	99·0	94·0	97·0	89·5	95·5	98·0	104·0	105·0	108·5	109·5	111·5	111·0	109·0	103·5	103·5	105·0	106·0	Slaughtered 4.1.35.	
913·5	902·5	743·5	899·5	882·5	892·0	890·5	864·5	844·5	837·5	794·0	828·5	833·5	877·0	895·0	913·0	923·0	953·5	941·0	95·0·5	683·0	551·5	464·0	262·0	—	
91·4	90·2	92·9	90·0	88·2	89·2	89·0	86·4	84·4	83·8	79·4	82·8	83·4	87·7	89·5	91·3	92·3	95·4	94·1	95·0	85·3	91·9	92·8	86·6	—	

APPENDIX 1A.

TABLES IX-XVI: OESTROUS OBSERVATIONS.

TABLE IX.

Group I.

Sheep No.		1932						1933												
		July.	August.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Jan.
29252	Oestrous observations commenced 24.7.32	,27	15,	—	—	—	—	—	14,	5, 22	8, 25	14,31	,17	5, 24	—	—	—	—	—	—
29270		—	1, 17	—	—	—	—	—	,24	12, 18	15,	1, 17	4, 19	6, 22	—	—	—	—	—	—
29324		—	—	—	—	—	—	—	8, 24	13, 30	15,	1, 18	4, 21	7, 24	10, 26	12,	—	—	—	—
29325		—	—	—	—	—	—	—	—	15,	2, 19	,24	,28	,17	—	—	—	—	—	—
29328		—	—	—	—	—	—	—	,22	10, 26	11, 28	,16	2, 19	5,	—	—	—	—	—	—
29340		—	—	—	—	—	—	—	,23	12,	3, 22	12, 31	—	—	—	—	—	—	—	—
29805		—	—	—	—	—	—	—	15,	4, 22	9, 27	15,	1, 19	8,	—	—	—	—	—	—
29815		—	—	—	—	—	—	—	8, 24	14,	1, 18	5, 23	9, 27	—	—	—	—	—	—	—
32476		—	—	—	—	—	—	—	—	3, 20	7, 24	—	—	15,	—	—	—	—	—	—
32491		—	—	—	—	—	—	—	—	16,	—	12,	—	—	—	—	—	—	—	—

TABLE X.

Group II.

35508	Oestrous observations commenced 24.7.32	—	—	—	—	—	—	—	,17	,24	11, 30	—	4, 22	10,	—	—	—	—	—	—
35509		—	—	—	—	—	—	14,	,20	9, 26	12, 30	,16	3, 20	—	—	—	—	—	—	,18
29274		—	15,	—	—	—	—	—	4,	10, 27	13,	1, 18	4, 21	8, 26	12, 29	—	—	—	—	—
29279		—	—	—	—	—	—	—	—	7, 24	10, 26	14,	—	—	—	—	—	—	—	—
29335		—	—	—	—	—	—	—	—	4, 21	7, 24	12, 31	15,	,19	—	—	—	—	—	—
29341		—	—	—	—	—	—	—	—	5, 23	—	14,	,18	6,	—	—	—	—	—	—
29793		—	—	—	—	—	—	—	—	6, 22	8, 25	12, 29	15,	2, 20	10,	—	—	—	—	—
29827		—	—	—	—	—	—	—	,18	8, 27	13,	1, 19	7, 26	13,	,20	—	—	—	—	—
32480		—	—	—	—	—	—	—	—	8, 25	—	—	—	—	—	—	—	—	—	—
32493		—	—	—	—	—	—	—	—	,29	—	—	—	—	—	—	—	—	—	—

TABLES IX-XVI: OESTROUS OBSERVATIONS.

EXPERIMENT 1A.

Group I.

1933						1934												1935	Date slaughtered.
July.	August.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	
5, 24	—	—	—	—	—	—	,23	12, 30	,17	5, 23	9, 27	15,	2,	—	—	—	—	—	1.11.34.
6, 22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	15.8.34.
7, 24	10, 26	12,	—	—	—	—	—	—	2, 19	6, 22	8, 20	12, 28	14, 30	,16	3, 20	6, 22	10, 26	12,	Not slaughtered.
,17	—	—	—	—	—	—	—	—	—	3, 28	15,	2, 20	7,	—	—	—	—	—	4.1.34.
5,	—	—	—	—	—	—	—	14, 31	—	,19	—	—	—	—	—	—	—	—	7.9.34.
—	—	—	—	—	—	—	9,	—	,22	—	—	—	—	—	—	—	—	—	7.9.34.
8,	—	—	—	—	—	—	—	2,20	6, 24	12, 30	,16	4, 23	10,	—	—	—	—	—	28.12.34.
—	—	—	—	—	—	—	—	6, 23	,28	15,	,19	—	—	—	—	—	—	—	27.9.34.
15,	—	—	—	—	—	—	—	—	—	—	6, 26	—	—	—	—	—	—	—	22.9.34.
—	—	—	—	—	—	—	—	—	—	6,	10,	—	3,	—	—	—	—	—	4.1.35.

Group II.

10,	—	—	—	—	—	—	,22	11, 29	,16	4, 21	8, 25	13,	1,	—	—	—	—	—	1.11.34.
—	—	—	—	—	—	,18	7,	12,	14,	,19	4, 22	9,	—	—	—	—	—	—	12.10.34.
8, 26	12, 29	—	—	—	—	—	—	—	,16	—	,23	10,	—	—	—	—	—	—	12.10.34.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	15.8.34.
,19	—	—	—	—	—	—	—	—	—	—	,27	14, 31	—	—	—	—	—	—	21.12.34.
6,	—	—	—	—	—	—	,10	—	—	—	—	,17	—	—	—	—	—	—	28.12.34.
2, 20	10,	—	—	—	—	—	—	11,	—	1, 19	5, 21.	9, 26	—	—	—	—	—	—	28.12.34.
13,	,20	—	—	—	—	—	—	—	4,	11, 29	—	5, 24	12,	—	—	—	—	—	28.12.34.
—	—	—	—	—	—	—	—	—	—	,19	—	10, 28	—	—	—	—	—	—	21.12.34.
—	—	—	—	—	—	—	—	—	—	7, 23	,26	,29	15,	—	—	—	—	—	21.12.34.

OESTROUS OBSERVATIONS—(*continued*).

APPENDIX 1A. TABLE XI. *Group III.*

Sheep No.		1932						1933											
		July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
35499	Oestrous observations commenced 24.7.32.	—	—	—	—	—	—	—	8,	13,	,16	—	—	—	—	—	—	—	—
35498		—	—	—	—	—	—	—	—	—	,23	9,	—	14,	—	—	—	—	—
29258		—	—	—	—	—	—	—	—	3, 22	,27	15,	,20	8,	—	—	—	—	—
29265		—	—	—	—	—	—	—	,21	—	15,	,20	7,	—	—	—	—	—	—
29273		—	—	—	—	—	—	—	14,	1,	3, 19	5,	7, 23	9, 26	—	—	—	—	—
29283		—	—	—	—	—	—	—	—	,17	,22	10, 28	15,	—	—	—	—	—	—
29330		—	—	—	Died 22.11.32	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29334		—	—	—	—	—	—	—	—	,20	6, 23	,27	—	—	—	—	—	—	—
32482		—	—	—	—	—	—	—	—	15,	—	—	—	—	—	—	—	—	—
32495		—	—	—	—	—	—	—	—	13, 30	—	3,	—	—	—	—	—	—	—

TABLE XII. *Group IV.*

29261	Oestrous observations commenced 24.7.32.	—	—	—	—	—	—	—	,24	13, 30	,17	4, 20	7, 23	10, 26	11, 28	—	—	—	—
29268		—	—	—	—	—	—	,20	6, 22	,28	,14	,17	3, 20	7, 24	—	—	—	—	—
29298		—	—	—	—	—	—	,31	15,	4,	6 ,	9, 27	—	—	—	—	—	—	—
29306		,26	13,	—	—	—	—	—	7, 26	15,	3, 21'	10, 28	14,	—	10, 28	—	—	—	—
29309		,29	15,	4,	—	—	—	12, 29	,16	6, 24	11, 29	,17	4, 21	9, 28	—	—	—	—	—
29316		—	—	—	—	—	—	—	,27	,17	4, 21	8, 27	14,	2, 21	—	—	—	—	—
29822		,29	—	—	—	—	—	,29	15,	7, 27	,16	5,	14,	1, 20	—	—	—	—	—
29825		—	—	—	—	—	—	—	,22	11, 29	,17	5,	15,	—	—	—	—	—	—
29830		—	—	—	—	—	—	—	14,	5, 21	—	—	—	—	—	—	—	—	—
35500		,30	—	—	—	—	—	,28	14,	4, 20	6,	11, 29	15,	,19	6, 23	11,	—	—	—

TABLE XIII. *Group V.*

35507	Oestrous observations commenced 8.7.32.	,22	—	—	—	,22	—	1,	8,	3, 21	10, 29	,18	5, 24	12, 29	,20	6,	—	—	—
35506		9, 26	12, 29	—	—	,23	—	,26	,28	—	4, 21	8, 26	12, 29	,16	3,	—	—	—	—
35505		11, 28	,16	—	—	—	2,	—	5, 23	14,	4,	15,	2. 21	9, 28	—	—	Died 13.12.33.	—	—
13367		,19	5, 23	9,	—	—	,18	14, 31	,17	6, 24	10,	14, 31	,16	3, 20	—	—	Died 29.12.33.	—	—
15329		,26	—	—	—	—	—	—	,22	11, 27	13, 30	,16	2, 21	8,	—	—	—	—	—
21658		9, 25	11, 29	15,	—	—	—	—	—	13, 30	15,	1, 17	3, 19	5, 22	7, 23	8,	—	—	—
25876		,17	—	—	—	—	—	3, 22	7,	—	,16	4, 22	8, 26	14,	—	—	—	—	—
25882		,25	12, 30	,17	—	,28	,16	,21	8,	Died 24.2.33.	—	—	—	—	—	—	—	—	—
25883		,22	9, 27	—	—	4,	—	4,	—	11, 28	14,	2, 19	4, 20	,24	—	—	—	—	—
25907		,23	10,	—	—	—	—	—	15,	4,	7, 24	,28	14,	1, 17	,20	—	—	—	—

OESTROUS OBSERVATIONS—(*continued*).

Group III.

EXPERIMENT 1A.

1933							1934												1935	Date slaughtered.
June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Jan.	
—	—	—	—	—	—	—	—	—	—	—	11,	—	—	—	—	—	—	—	—	7.9.34.
—	14,	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	23.8.34.
,20	8,	—	—	—	—	—	—	—	,16	—	9, 27	13,	,19	—	—	—	—	—	—	1.11.34.
7,	—	—	—	—	—	—	—	—	13, 30	—	5, 22	,28	—	—	—	—	—	—	—	12.10.34.
7, 23	9, 26	—	—	—	—	—	—	—	—	—	11, 27	—	—	—	—	—	—	—	—	14.9.34.
15,	—	—	—	—	—	—	—	—	,30	—	—	—	—	—	—	—	—	—	—	7.9.34.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Died 22.11.32.
—	—	—	—	—	—	—	—	—	—	10, 27	—	1, 19	—	—	—	—	—	—	—	22.9.34.
—	—	—	—	—	—	—	—	—	—	—	—	2,	9,	—	—	—	—	—	—	1.11.34.
—	—	—	—	—	—	—	—	—	—	12,	,17	,21	8,	13, 31	—	—	—	—	—	27.10.34.

Group IV.

7, 23	10, 26	11, 28	—	—	—	—	1,	7,	—	—	—	—	—	—	—	—	—	—	—	30.8.34.
3, 20	7, 24	—	—	—	—	—	—	—	—	5,	—	11, 28	14, 30	—	—	—	—	—	—	4.10.34.
—	—	—	—	—	—	—	—	—	—	—	6, 23	9, 26	—	—	—	—	—	—	—	4.10.34.
14,	—	10, 28	—	—	—	—	—	—	—	—	,25	12,	1,	—	—	—	—	—	—	4.10.34.
4, 21	9, 28	—	—	—	—	—	—	—	—	,28	15,	3, 20	—	—	—	—	—	—	—	27.9.34.
14,	2, 21	—	—	—	—	—	—	—	—	—	—	,16	—	—	—	—	—	—	—	22.9.34.
14,	1, 20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	30.8.34.
15,	—	—	—	—	—	—	—	—	—	—	,19	—	—	—	—	—	—	—	—	14.9.34.
—	—	—	—	—	—	—	Died 16.1.34.	—	—	—	—	—	—	—	—	—	—	—	—	Died 16.1.34.
15,	,19	6, 23	11,	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	30.8.34.

Group V.

5, 24	12, 29	,20	6,	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	23.8.34.
12, 29	,16	3,	—	—	—	—	—	—	,27	12, 29	,16	,20	7,	10, 27	—	—	—	—	—	14.12.34.
2. 21	3, 28	—	—	Died 13.12.33.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Died 13.12.33.
,16	3, 20	—	—	Died 29.12.33.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Died 29.12.33.
2, 21	8,	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	23.8.34.
3, 19	5, 22	7, 23	8,	—	—	—	—	—	—	—	7, 23	8, 24	10, 26	11, 29	13, 29	,16	—	—	—	7.12.34.
8, 26	14,	—	—	—	—	—	—	—	12, 29	15,	3, 20	6,	11,	—	—	—	—	—	—	14.12.34.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Died 24.2.33.
4, 20	,24	—	—	—	—	—	,19	—	—	—	—	13,	—	—	—	—	—	—	—	22.9.34.
14,	1, 17	,20	—	—	—	—	—	—	—	8, 24	11,	14,	,17	,21	6, 23	9,	—	—	—	30.11.34.

OESTROUS OBSERVATIONS—(*continued*).

Group VI.

APPENDIX 1A. TABLE XIV.

Sheep No.		1932			1933											1934	
		Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
15257	Oestrous observations commenced 7.10.32.	—	—	—	—	,22	11, 27	13, 30	,17	3, 20	8, 27	—	1,	—	—	,29	15,	,19
15327		—	—	—	—	—	13.	15,	,18	3,	7, 25	10,	—	—	—	—	—	4, 20
21504		—	—	—	—	9,	13, 31	—	3,	6,	—	—	—	—	—	—	—	—
21607		—	—	—	—	—	5, 21	6, 24	10, 27	13, 30	,17	3,	Died 30.9.33.	—	—	—	—	—
24928		—	—	—	—	,28	,17	4, 21	9, 26	13,	1, 19	5,	—	—	—	—	—	8, 26
25873		—	—	—	—	—	4,	8, 25	13, 31	,18	6, 24	12,	—	—	—	—	—	,17
35501		—	—	—	—	10,	3, 20	5, 22	9, 27	—	—	—	—	—	—	—	—	—
35496		—	—	—	—	,24	13, 31	,18	5, 24	11, 28	,16	—	—	—	—	—	—	,18
35502		—	—	—	—	,23	12, 30	,16	3, 21	8, 26	14,	1,	—	—	—	—	—	,23
35497		—	—	—	—	15,	,23	10, 23	15,	1, 19	8,	12, 29	—	—	—	—	3, 19	6,

TABLE XV. *Group VII.*

15351	Oestrous observations commenced 7.10.32.	—	—	—	—	6, 22	11, 28	15,	3, 19	6, 23	10, 28	14, 31	—	—	—	—	12, 29	,16
15921		—	—	—	,23	9, 27	15,	,20	7, 25	12, 29	,17	5, 24	—	—	—	11, 29	,16	—
22210		—	—	—	—	—	3, 18	,20	,24	,26	13, 30	—	—	—	—	—	—	—
22547		—	—	—	—	13,	1, 18	,19	5, 22	—	9, 26	12, 28	—	,16	—	—	—	3,
24955		—	—	—	—	—	—	5,	8,	,26	12,	—	—	—	—	—	—	—
25105		—	—	—	—	—	4, 21	7,	—	;16	,21	7,	—	—	—	—	12, 29	,16
25908		—	—	—	,14	1, 18	7, 25	11, 29	,17	4, 22	10,	15,	1,	—	—	,18	5, 23	9, 27
25938		—	—	—	—	8,	—	—	,24	11,	—	—	—	—	—	—	—	—
35503		—	—	—	—	,28	,18	5, 23	12, 29	,17	5, 23	,31	—	—	—	,30	,18	,23
35504		—	—	—	—	15,	4, 22	9, 27	15,	2, 20	8, 26	13,	—	—	—	—	2, 19	7, 25

TABLE XVI. *Group VIII.*

Sheep No.		1933								1934					
		May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	
21500	Oestrous observations commenced 1.5.33.	1, 16	3, 20	8,	11, 30	15,	—	—	—	1, 18	4, 21	10, 27	13, 30	,17	2
22059		3, 19	5, 22	10,	—	—	—	—	—	1, 17	3, 20	9, 25	12, 27	13, 30	,1
25025		3, 21	6, 22	12,	—	—	—	—	—	7, 24	9, 26	14,	1, 18	4, 21	7
25948		1, 18	4, 21	8, 25	12, 28	—	—	—	,26	11, 28	14,	2, 19	5, 22	9, 26	1
35708		2, 20	6,	—	—	—	—	—	—	,24	10, 28	,16	2, 20	7, 25	1
35732		2, 19	5, 22	10,	—	—	—	—	—	—	,21	10, 26	12, 29	,16	2
35994		3, 19	5, 21	8, 24	10,	—	—	—	—	—	13,	—	6, 23	9, 25	1
37058		2, 19	5, 23	11, 28	,16	3,	—	—	—	4, 22	9, 26	15,	3, 20	7, 24	1
37059		1, 17	3, 21	8, 24	10, 27	—	—	—	,25	12,	15,	6,	9,	13,	1
37061		4, 22	6,	13,	—	—	—	—	—	,17	2, 18	6, 23	8, 24	11, 27	1

OESTROUS OBSERVATIONS—(*continued*).

Group VI.

EXPERIMENT 1A.

1934															1935	Date slaughtered.
Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Jan.	
1,	—	—	,29	15,	,19	9, 26	12,	15,	1, 18	—	10,	—	—	—	—	—	9.11. 34.
—	—	—	—	—	4, 20	9,	—	—	,17	3,	5,	—	—	—	—	—	11.1.35.
—	—	—	—	—	—	—	—	14,	,18	4,	6, 23	—	—	—	—	—	11.1.35.
Died 30.9.33.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Died 30.9.33.
—	—	—	—	—	8, 26	,16	2, 19	,24	10, 28	—	3, 20	7, 25	—	—	—	—	22.11.34.
—	—	—	—	—	,17	6, 24	11, 29	,17	3, 21	8, 27	—	—	—	—	—	—	11.1.35.
—	—	—	—	—	—	7, 27	13, 30	,18	3, 21	8,	15,	4,	—	—	—	—	14.12.34.
—	—	—	—	—	,18	8, 26	12, 29	,17	4, 22	10, 27	15,	3,	—	—	—	—	30.11.34.
—	—	—	—	—	,23	12, 30	,17	4, 22	8, 27	—	—	—	—	—	—	—	11.1.35.
—	—	—	—	3, 19	6,	13, 30	—	4, 21	,26	13,	—	3,	—	—	—	—	30.11.34.

Group VII.

—	—	—	—	12, 29	,16	6, 19	9, 26	13, 29	15,	2, 19	5, 22	8, 25	12, 29	—	—	—	30.11.34.
—	—	—	11, 29	,16	—	1,	,24	12,	,17	4, 23	,26	—	—	—	10, 29	,16	Not slaughtered.
—	—	—	—	—	—	10, 27	—	—	,19	—	,26	11,	—	—	—	—	16.11.34.
—	,16	—	—	—	3,	8, 25	10,	12, 23	,30	—	2,	4,	—	,30	,17	,19	Not slaughtered.
—	—	—	—	—	—	—	—	—	—	—	,21	—	—	—	,19	—	Not slaughtered.
—	—	—	—	12, 29	,16	7, 26	,30	,18	5, 22	10, 27	14,	,19	—	—	—	—	7.12.34.
1,	—	—	,18	5, 23	9, 27	,17	3, 21	9, 27	14,	2,	6,	2,	—	—	—	—	14.12.34.
—	—	—	—	—	—	—	11,	15,	—	—	—	—	—	—	—	—	14.9.34.
—	—	—	,30	,18	,23	—	—	7, 25	12,	—	6, 24	—	—	—	—	—	22.11.34.
—	—	—	—	2, 19	7, 25	,16	3, 21	10, 28	15,	3. 22	8, 27	15,	—	—	—	—	9.11.34.

Group VIII.

1934												1935	Date slaughtered.
Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Jan.	
—	1, 18	4, 21	10, 27	13, 30	,17	2, 19	6, 24	10, 29	15,	2,	—	—	—	9.11.34.
—	1, 17	3, 20	9, 25	12, 27	13, 30	,17	3, 20	—	4,	—	—	—	—	14.12.34.
—	7, 24	9, 26	14,	1, 18	4, 21	7, 24	11,	—	—	—	—	—	—	21.12.34.
	11, 28	14,	2, 19	5, 22	9, 26	13, 30	,17	3, 21	7,	—	—	,16	2, 18	Not slaughtered.
—	,24	10, 28	,16	2, 20	7, 25	12,	,17	5,	—	—	—	—	—	22.11.34.
—	—	,21	10, 26	12, 29	,16	2, 19	6, 24	—	—	—	—	—	—	16.11.34.
—	—	13,	—	6, 23	9, 25	10, 27	13, 31	,16	2, 18	—	—	—	—	7.12.34.
—	4, 22	9, 26	15,	3, 20	7, 24	10, 28	15,	2, 21	9,	—	—	—	—	4.1.35.
	12,	15,	6,	9,	13,	15,	,20	,22	12, 30	—	—	—	—	9.11.34.
—	,17	2, 18	6, 23	8, 24	11, 27	12, 28	14, 31	,16	,18	—	—	—	—	4.1.35.

TABLES XVII-XXIV: THE SEXUAL SEASONS.

APPENDIX 1A. TABLE XVII. *Group I.* EXPERIMENT 1A.

Sheep No.		Sexual Season (1932) July-August Periodicity of oestrus in days.	Duration.	Dioestrous cycles.	Anoestrous Period (1932–33) September-January.	Sexual Season (1933) February–August Periodicity of oestrus in days.	Duration.	Dioestrous cycles.	Anoestrous Period (1933–34) September–January.	Sexual Season (1934) February—August Periodicity of oestrus in days.	Duration.	Dioestrous cycles.	Anoestrous Period (1934–35) September—January. (Up to date slaughtered.)	Date slaughtered.
			days.	No.	days.		days.	No.	days.		days.	No.	days.	
29252	Oestrous observations commenced 24.7.32.	19	20	2	182	19 17 17 17 19 17 17 18 19	161	10	213	17 18 18 18 18 17 18 18 18	161	10	91+	1.11.34.
29270		16	17	2	190	16 16 18 16 16 18 15 17 16	149	10	389+		0	0	(see 1933—1934)	15.8.34.
29324		—	0	0	200+	16 17 17 16 16 17 17 17 16 17 17 16 17	217	14	201	17 17 16 17 12 22 16 17 16 17 17 17 17 16 18 16	286+	17	0	Not slaughtered.
29325		—	0	0	234+	18 17 35 34 19	125	6	289	25 18 17 18 18	97	6	150+	4.1.35.
29328		—	0	0	213+	16 16 16 17 18 17 17 17 16	134	10	251	17 49	67	3	111+	7.9.34.
29340		—	0	0	214+	17 22 19 20 19	98	6	253	72	73	2	138+	7.9.34.
29805		—	0	0	206+	17 18 18 18 18 17 18 19	144	9	236	18 17 18 18 18 17 18 19 18	162	10	140+	28.12.34.
29815		—	0	0	199+	16 18 18 17 17 18 17 18	140	9	251	17 36 17 35	106	5	100+	27.9.34.
32476		—	0	0	222+	17 18 17 82	135	5	325	20	21	2	88+	22.9.34.
32491		—	0	0	235+	57	58	2	358	35 54	90	3	154+	4.1.35.

TABLE XVIII. *Group II.*

35508	Oestrous observations commenced 24.7.32.	—	0	0	208+	35 18 19 35 18 18	144	7	226	19 18 18 18 17 18 17 18 19	161	10	92+	1.11.34.
35509		—	0	0	174+	37 17 17 17 18 16 18 17	158	9	211	19 33 33 35 16 18 17	174	8	95+	12.10.34.
29274		—	1	1	172	34 17 17 18 17 17 17 17 17 18 17 17	207	12	229	68 17	86	3	94+	12.10.34.
29279		—	0	0	226+	17 17 16 18	69	5	458+		0	0	(see 1933—1934)	15.8.34.
29335		—	0	0	223+	17 17 17 18 19 15 34	137	8	342	17 17	35	3	143+	21.12.34.
29341		—	0	0	224+	18 52 34 18	124	5	218	157	158	2	164+	28.12.34.
29793		—	0	0	225+	18 17 17 17 17 17 17 18 21	158	10	212	51 18 17 16 18 17	138	7	155+	28.12.34.
29827		—	0	0	209+	18 19 17 18 18 19 18 17 38	184	10	226	37 18 37 19 19	131	6	138+	28.12.34.
32480		—	0	0	227+	17	18	2	419	52 18	71	3	146+	21.12.34.
32493		—	0	0	248+	—	1	1	403	16 33 33 17	101	5	128+	21.12.34.

APPENDIX 1A. TABLE XIX. THE SEXUAL SEASONS—(*continued*). *Group III.* EXPERIMENT 1A.

Sheep No.		Sexual Season (1932) July-August Periodicity of oestrus in days.	Duration.	Dioestrous cycles.	Anoestrous Period (1932–33) September–January.	Sexual Season (1933) February–August Periodicity of oestrus in days.	Duration.	Dioestrous cycles.	Anoestrous Period (1933–34) September–January.	Sexual Season (1934) February—August Periodicity of oestrus in days.	Duration.	Dioestrous cycles.	Anoestrous Period (1934–35) September—January. (Up-to-date slaughtered.)	Date slaughtered.
			days.	No.	days.		days.	No.	days.		days.	No.	days.	
35499	Oestrous observations commenced 24.7.32.	—	0	0	199+	33 34	68	3	389		1	1	119+	7.9.34.
35498		—	0	0	273+	16 66	83	3	405+		0	0	(see 1933–1934)	23.8.34.
29258		—	0	0	222+	19 36 18 36 18	128	6	250	54 18 17 36	126	5	105+	1.11.34.
29265		—	0	0	212+	53 35 18	107	4	278	17 36 17 36	108	5	106+	12.10.34.
29273		—	0	0	205+	15 33 16 16 33 16 16 17	163	9	288	16	17	2	110+	14.9.34.
29283		—	0	0	236+	36 18 18 18	91	5	287		1	1	161+	7.9.34.
29330		—	0	0	Died 22.11.32.	—	—	—	—		—	—	—	Died 22.11.32.
29334		—	0	0	239+	17 17 34	69	4	317	17 34 18	71	4	95+	22.9.34.
32482		—	0	0	234+	—	1	1	443	37	38	2	115+	1.11.34.
32495		—	0	0	232+	17 34	52	3	343	35 35 17 36 18	142	6	57+	27.10.34.

TABLE XX. *Group IV.*

29261	Oestrous observations commenced 24.7.32.	—	0	0	215+	17 17 18 17 16 18 16 17 16 16 17	186	12	125	37	38	2	204+	30.8.34.
29268		—	0	0	180+	17 16 34 17 33 17 17 17 17	186	10	254	67 17 16 16	117	5	66+	4.10.34.
29298		—	0	0	191+	15 17 33 33 18	117	6	343	17 17 17	52	4	100+	4.10.34.
29306		18	19	2	177	19 17 19 18 19 18 17 57 18	203	10	269	18 19	38	3	95+	4.10.34.
29309		17 20	38	3	129	17 18 18 18 18 18 18 18 17 18 19	198	12	273	17 19 17	54	4	99+	27.9.34.
29316		—	0	0	218+	18 18 17 17 19 18 18 19	145	9	329		1	1	98+	22.9.34.
29822		—	1	1	183	17 20 20 20 19 40 17 19	173	9	406+		0	0	(see 1933–1934)	30.8.34.
29825		—	0	0	213+	17 18 19 18 41	114	6	337		1	1	118+	14.9.34.
29830		—	0	0	205+	19 16	36	3	302		—	—	—	Died 16.1.34
35500		—	1	1	181	17 18 16 17 35 18 17 34 18 17 19	227	12	353+		0	0	(see 1933–1934)	30.8.34.

THE SEXUAL SEASONS—(*continued*).

APPENDIX 1A. TABLE XXI. *Group V.* EXPERIMENT 1A.

Sheep No.		Sexual Season (1932) July-August Periodicity of oestrus in days.	Duration.	Dioestrous cycles.	Anoestrous Period (1932–33) September–January.	Sexual Season (1933) February–August Periodicity of oestrus in days.	Duration.	Dioestrous cycles.	Anoestrous Period (1933–34) September–January.	Sexual Season (1934) February—August Periodicity of oestrus in days.	Duration.	Dioestrous cycles.	Anoestrous Period (1934–35) September—January. (Up-to-date slaughtered.)	Date slaughtered.
			days.	No.	days.		days.	No.	days.		days.	No.	days.	
35507	Oestrous observations commenced 8.7.32.	—	1	1	122	40 38 23 18 20 19 19 18 19 18 17 22 17	289	14	351+		0	0	(see 1933–1934)	23.8.34.
35506		17 17 17	52	4	85	64 33 35 17 17 18 17 17 17 18	255	11	235	16 17 17 34 17 34 17	155	8	109+	14.12.34.
35505		17 19	37	3	107	65 18 19 21 41 18 19 18 19	239	10	138+		—	—	—	Died 13.12.34.
13367		17 18 18 17	53	4	99	27 17 17 17 18 17 34 17 16 17 17	215	12	163+		—	—	—	Died 29.12.33.
15329		—	1	1	210	17 16 17 17 16 17 19 17	137	9	411+		0	0	(see 1933–1934)	23.8.34.
21658		16 17 18 17	70	5	178	17 16 16 16 17 16 16 17 16 16 16	180	12	241	16 16 16 16 16 16 18 15 16 17	163	11	52+	7.12.34.
25876		—	1	1	169	19 16 68 18 18 17 18 18	193	9	240	17 17 18 17 17 35	62	7	156+	14.12.34.
25882		18 18 18	55	4	71	18 36 18 Died 24.2.33	—	—	—		—	—	—	Died 24.2.33.
25883		18 18	37	3	68	61 66 17 17 18 17 16 16 34	263	10	178	145	146	2	101+	22.9.34.
25907		18	19	2	188	17 34 17 34 17 17 16 34	187	9	230	16 17 34 33 35 16 17 16	185	9	52+	30.11.34.

TABLE XXII. *Group VI.*

15257	Oestrous observations commenced 7.10.32.	—	—	—	138+	17 16 18 17 17 17 17 18 19 36	192	11	118	17 35 18 17 17 33 17 17 53	225	10	91+	9.11.34
15327		—	—	—	157+	33 33 16 34 18 16	151	7	177	16 17 100 16 33	183	6	159+	11.1.35.
21504		—	—	—	125+	32 18 33 34	118	5	341	35 16 33 17	102	5	141+	11.1.35.
21607		—	—	—	149+	16 16 18 16 17 17 17 17 17	152	10	Died 30.9.33.		—	—	—	Died 30.9.33.
24928		—	—	—	144+	17 18 17 18 17 18 18 18 17	159	10	186	18 18 17 17 35 17 18 36 17 18 18	230	12	68+	22.11.34.
25873		—	—	—	148+	35 17 18 18 18 18 18 19	162	9	188	17 18 18 18 18 17 18 17 19	161	10	168+	11.1.35.
35501		—	—	—	126+	21 17 16 17 17 18	107	7	283	20 17 17 18 16 18 17 38 20	182	10	101+	14.12.34.
35496		—	—	—	140+	17 18 18 17 19 18 17 18	143	9	216	18 18 17 17 18 18 18 18 17 19 19	197	12	88+	30.11.34.
35502		—	—	—	139+	17 18 17 17 18 18 18 18 18	160	10	205	17 18 18 17 18 17 19	125	8	198+	11.1.35.
35497		—	—	—	131+	36 18 18 17 17 18 19 35 17	196	10	126	16 18 35 17 35 17 36 17 52	244	10	88+	30.11.34.

THE SEXUAL SEASONS—(*continued*).

APPENDIX 1A. TABLE XXIII. *Group VII.* EXPERIMENT 1A.

Sheep No.		Sexual Season (1932) July-August Periodicity of oestrus in days.	Duration.	Dioestrous cycles.	Anoestrous Period (1932–33) September–January.	Sexual Season (1933) February–August Periodicity of oestrus in days.	Duration.	Dioestrous cycles.	Anoestrous Period (1933–34) September–January.	Sexual Season (1934) February—August Periodicity of oestrus in days.	Duration.	Dioestrous cycles.	Anoestrous Period (1934–35) September—January. (Up-to-date slaughtered.)	Date slaughtered.
			days.	No.	days.		days.	No.	days.		days.	No.	days.	
15351	Oestrous observations commenced 7.10.32.	—	—	—	122+	16 17 17 18 18 16 18 17 17 18 17 17	207	13	133	17 18 18 13 21 17 17 16 17 17 17 17 17 17 17	291	17	32+	30.11.34.
15921		—	—	—	108+	17 18 16 36 17 18 18 17 18 19 19	214	12	108	18 18 44 54 18 36 17 19 34	259	10	105+	Not slaughtered.
22210		—	—	—	147+	15 36 34 33 17 17	150	7	222	17 84 68 16	186	5	66+	16.11.34.
22547		—	—	—	129+	16 17 32 16 48 17 17 16 49	246	10	109	33 17 16 42 16 33 33 33	214	9	87	Not slaughtered.
24955		—	—	—	180+	33 49 16	99	4	404		1	1	120	Not slaughtered.
25105		—	—	—	148+	17 17 70 35 17	157	6	157	17 18 19 19 35 18 18 17 18 17 18 36	251	13	79+	7.12.34.
25908		—	—	—	99+	18 17 17 18 17 18 18 18 18 18 36 17	231	13	107	18 18 17 18 18 17 18 18 18 18 18 35 27	259	14	103+	14.12.34.
25938		—	—	—	124+	105 18	124	3	303	34	35	2	122+	14.9.34.
35503		—	—	—	144+	18 18 18 19 17 19 18 18 39	185	10	120	19 36 73 18 18 55 18	238	8	90+	22.11.34.
35504		—	—	—	131+	17 18 18 18 18 18 18 18 18 18	180	11	141	17 19 18 19 18 18 19 18 18 18 19 17 19 19	257	14	55+	9.11.34.

TABLE XXIV. *Group VIII.*

21500	Oestrous observations commenced 1.5.33.	—	—	—	—	15 18 17 18 34 19 16	138+	8	107	17 17 17 17 17 17 17 17 16 17 17 18 17 19 17 17	275	17	38+	9.11.34.
22059		—	—	—	—	16 17 17 18	69+	5	174	16 17 17 17 16 18 15 16 18 18 16 17 46	247	14	101+	14.12.34.
25025		—	—	—	—	18 16 16 20	71+	5	178	17 16 17 16 18 17 16 17 17 17 17	186	12	163+	21.12.34.
25948		—	—	—	—	17 17 17 17 17 18 16	120+	8	120	16 17 17 16 17 17 17 17 17 18 17 17 17 18 17	256	16	99	Not slaughtered.
35708		—	—	—	—	18 17	36+	3	231	17 18 16 17 18 17 18 18 35 19	194	11	109+	22.11.34.
35732		—	—	—	—	17 17 17 18	70+	5	225	17 16 17 17 17 17 17 17 18	154	10	115+	16.11.34.
35994		—	—	—	—	16 17 16 17 16 17	100+	7	186	52 17 16 16 16 17 16 18 16 17 16	218	12	80+	17.12.34.
37058		—	—	—	—	17 17 18 18 17 19 18	125+	8	122	18 18 17 17 19 17 17 17 17 18 17 18 19 19	249	15	117+	4.1.35.
37059		—	—	—	—	16 17 18 17 16 17 17	119+	8	119	18 34 19 34 34 33 35 33 21 18	280	11	40+	9.11.34.
37061		—	—	—	—	18 15 37	71+	4	187	16 16 16 17 16 16 17 16 16 16 16 17 16 33	245	15	108+	4.1.35.

NOTE :—

(*a*) In the above Tables XVII to XXI, the sexual season, 1932, is incomplete due to observations having been commenced near the end of the sexual season.

(*b*) In Tables XXII and XXIII oestrous observations are seen to have been commenced during the anoestrous period, 1932–1933.

(*c*) In Table XXIV oestrous observations are seen to have been commenced during the sexual season, 1933.

(*d*) In Tables XVII to XXIV, the anoestrous periods 1934–1935 are seen to have been interupted by slaughtering.

(*e*) In instances in which the commencement or the termination of the sexual season and the anoestrous period were not observed a plus sign indicates the probability of a longer period.

FREQUENCIES OF THE PERIODICITY OF OESTROUS.

APPENDIX 1A. TABLE XXV. EXPERIMENT 1A.

Sexual Season, 1932. *Sexual Season*, 1933.

Days.	16.	17.	18.	19.	20.	Totals.	15.	16.	17.	18.	19.	20.	21.	22.	23.	27.	32.	33.	34.	35.	36.	37.	38.	39.	40.	41.	48.	49.	52.	53.	57.	61.	64.	65.	66.	68.	70.	82.	105.	Totals.
Group I.....	1	—	—	1	—	2	1	15	27	15	7	1	—	1	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	1	—	71
,, II.....	—	—	—	—	—	0	1	2	26	17	4	—	1	—	—	—	—	—	3	2	—	1	1	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	59
,, III.....	—	—	—	—	—	0	1	5	4	61	1	—	—	—	—	—	—	3	3	1	3	—	—	—	—	—	—	—	—	1	—	—	—	—	1	—	—	—	—	29
,, IV.....	—	1	1	—	1	3	1	7	25	23	11	3	—	—	—	—	—	3	2	1	—	—	—	—	1	1	—	—	—	—	1	—	—	—	—	—	—	—	—	79
,, V.....	1	8	8	1	—	18	—	15	30	16	8	1	1	1	1	1	—	1	5	1	1	—	1	—	1	—	—	—	—	—	—	1	1	1	1	1	—	—	—	89
,, VI.....	No	obse	rvat	ions.		—	—	7	27	29	4	—	1	—	—	—	1	3	2	2	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	78
,, VII.....		,,				—	1	7	23	30	4	—	—	—	—	—	1	2	1	1	3	—	—	1	—	—	1	2	—	—	—	—	—	—	—	—	1	—	1	79
,, VIII....		,,				—	2	10	22	12	2	1	—	—	—	—	—	—	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	51
Totals.....	2	9	9	2	1	23	7	68	184	148	41	6	3	2	1	1	2	12	18	9	9	2	2	1	2	1	1	2	1	1	2	1	1	1	2	1	1	1	1	535

TABLE XXV (*continued*). *Sexual Season*, 1934.

Days.	12.	13.	15.	16.	17.	18.	19.	20.	21.	22.	25.	27.	33.	34.	35.	36.	37.	38.	42.	44.	46.	49.	51.	52.	53.	54.	55.	67.	68.	72.	73.	84.	100.	145.	157.	Totals.
Group I.....	1	—	—	5	16	17	1	1	—	1	1	—	—	—	2	1	—	—	—	—	—	1	—	—	—	1	—	—	—	1	—	—	—	—	—	49
,, II.....	—	—	—	3	9	10	5	—	—	—	—	—	4	—	1	—	2	—	—	—	—	—	1	1	—	—	—	—	1	—	—	—	—	—	1	38
,, III.....	—	—	—	1	5	3	—	—	—	—	—	—	—	1	2	4	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	18
,, IV.....	—	—	—	2	6	1	2	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	13
,, V.....	—	—	1	11	11	2	—	—	—	—	—	—	1	3	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	32
,, VI.....	—	—	—	5	26	23	4	2	—	—	—	—	3	—	5	2	—	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	1	—	—	73
,, VII.....	—	1	—	4	21	28	9	—	1	—	—	1	4	2	2	3	—	—	1	1	—	—	—	—	—	1	1	—	1	—	1	1	—	—	—	83
,, VIII....	—	—	1	28	58	19	6	—	1	—	—	—	3	3	2	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	122
Totals.....	1	1	2	59	152	103	27	3	2	1	1	1	15	9	16	10	4	1	1	1	1	1	1	1	1	3	1	1	2	1	1	1	1	1	1	428

ANALYSES OF FEEDSTUFFS.

APPENDIX 1A. TABLE XXVI. EXPERIMET 1A.

Feed.	Crude Protein.	P_2O_5.	CaO.	MgO.	Na_2O.	K_2O.	Soluble Ash.	Fibre.	Cl.	Moisture.	Ether soluble extract.	Total ash.
Maize (yellow flint)	12·2	·62	·03	·02	·015	·4	1·4	1·7	·08	8·6	6·2	1·3
Teff hay	7·9	·29	·43	·29	·03	1·3	2·5	28·5	·2	8·2	1·1	6·7
Cottonseed meal	40·0	1·6	·4	1·0	·38	1·2	6·0	9·0	·04	7·9	10·2	6·7
Peanut meal	48·9	1·9	·18	·6	·2	1·8	5·1	3·9	·05	9·9	47·3	2·1
Blood meal	70·3	·35	·17	·03	1·60	·40	3·0	—	1·0	9·8	·9	3·4
Lucerne hay	15·0	·54	2·7	·75	·43	3·6	8·9	34·8	·71	8·0	2·4	8·9
Bone meal	30·0	22·0	30·0	·65	·55	·1	65·5	—	·11	5·5	1·3	66·8

NOTE.—The above analyses were supplied by Dr. A. I. Malan, Biochemist, Onderstepoort.

APPENDIX 1B.

EXPERIMENT 1B.

TABLES I–V: WEIGHTS OF SHEEP IN POUNDS.

TABLE I. *Group I.*

Sheep No.	1934.				1935.																					
	7.11.	24.11.	8.12.	22.12.	4.1.	19.1.	2.2.	16.2.	2.3.	16.3.	30.3.	13.4.	27.4.	11.5.	25.5.	8.6.	22.6.	6.7.	20.7.	3.8.	17.8.	31.8.	14.9.	28.9.	12.10.	26.10.
39839....	69·0	73·0	71·5	75·0	76·5	76·5	78·0	77·5	77·5	78·5	79·0	79·5	80·5	80·0	82·0	83·0	81·0	84·0	85·0	82·0	85·5	86·5	89·5	99·0	80·5	80·0
39856....	65·5	69·5	67·0	68·5	71·0	69·0	72·0	72·5	70·0	68·5	72·0	71·0	74·0	76·0	76·5	77·5	75·0	76·0	79·0	82·0	82·0	83·0	85·5	84·0	75·5	75·0
39865....	67·5	63·5	59·0	65·5	63·0	63·5	66·5	67·5	67·5	67·5	69·0	69·5	74·0	75·0	80·0	81·0	78·0	81·0	84·0	85·0	82·0	84·0	86·5	86·0	80·0	77·5
39895....	57·0	58·5	54·0	60·5	60·0	60·5	65·0	64·0	67·0	66·0	67·5	67·5	69·5	70·0	72·0	70·5	69·0	72·5	74·5	73·5	74·0	72·5	77·0	76·5	71·5	69·5
39909....	65·5	62·5	62·5	64·5	64·0	64·0	67·0	69·5	68·0	67·5	69·0	69·5	71·5	71·5	72·5	74·5	74·5	76·0	80·5	79·0	78·5	79·0	80·5	76·0	75·0	68·5
39920....	74·5	74·5	67·5	75·0	71·5	72·0	76·0	74·5	77·0	75·5	77·5	75·5	80·0	81·0	83·0	75·0	83·0	87·5	89·5	94·0	94·5	93·0	94·5	92·0	86·5	86·5
39921....	63·5	65·0	57·5	63·0	65·5	67·0	68·5	69·0	71·5	70·5	69·5	68·0	69·0	70·0	71·0	72·5	68·0	74·5	72·5	73·5	75·5	76·5	78·5	79·5	73·5	69·0
39925....	63·0	61·5	57·0	60·5	61·5	62·0	66·0	66·0	67·0	65·5	65·0	68·0	70·5	73·0	73·0	74·0	75·0	74·0	77·5	78·5	77·0	78·0	82·0	80·0	76·0	75·0
40614....	50·5	48·0	44·5	48·0	45·5	45·5	46·5	47·0	48·0	48·0	45·5	45·0	49·0	51·5	52·0	52·5	51·5	54·0	53·0	53·5	51·5	54·0	55·0	53·0	52·0	50·0
40807....	57·0	53·0	49·5	57·0	57·0	55·0	58·5	56·5	56·0	55·5	57·0	57·0	60·5	57·0	61·0	60·5	60·5	61·0	62·0	62·0	60·5	61·0	61·0	62·5	57·0	57·5
Total....	633·0	629·0	590·0	637·5	635·5	636·0	664·0	664·0	670·0	662·0	671·0	670·5	698·5	705·0	723·0	721·0	715·5	740·5	757·5	763·0	761·0	767·5	790·0	788·5	727·5	708·5
Average..	63·3	62·9	59·0	63·8	63·6	63·6	66·4	66·4	67·0	66·2	67·1	67·0	69·8	70·5	72·3	72·1	71·6	74·0	75·8	76·3	76·1	76·8	79·0	78·8	72·8	70·8

TABLE II. *Group II.*

39846....	65·5	63·5	61·5	68·5	68·5	71·0	71·5	73·5	71·5	67·5	71·0	70·0	76·0	76·5	78·5	80·0	77·5	82·5	81·5	84·5	82·0	86·0	87·0	87·0	79·5	76·0
39859....	67·0	59·0	59·0	64·0	64·0	65·0	65·5	67·0	68·0	66·0	67·0	65·5	73·0	68·0	72·0	75·0	69·0	74·5	74·5	75·0	76·0	74·5	76·0	76·5	72·0	69·0
39861....	60·0	60·5	60·5	65·0	65·0	65·5	68·0	69·5	69·0	70·0	72·5	72·0	76·5	74·0	77·0	77·0	79·0	80·5	82·5	83·0	85·5	86·0	91·0	85·5	77·0	72·0
39874....	63·0	53·0	50·5	56·0	57·0	58·0	60·0	61·0	59·5	60·0	59·5	61·5	64·5	66·0	67·0	69·5	68·0	72·5	73·5	73·5	73·5	74·0	78·0	74·5	70·5	69·0
39889....	69·5	70·0	69·5	77·5	75·0	75·5	76·5	78·5	79·0	79·5	84·5	85·0	89·0	88·0	89·0	90·0	89·5	94·0	97·5	98·0	99·0	97·5	100·0	98·5	87·5	83·0
39901....	52·0	52·5	52·0	56·0	57·5	57·0	59·0	60·0	62·0	62·0	64·0	64·0	67·5	66·5	68·0	67·0	67·5	69·5	71·5	71·0	69·0	70·5	75·5	74·5	71·5	68·5
39916....	65·5	65·0	64·0	67·0	67·5	67·5	70·0	71·0	66·0	70·0	69·0	70·0	72·5	71·5	75·0	75·5	72·0	77·5	78·5	78·0	79·0	79·5	81·0	78·5	74·0	72·0
39922....	74·0	70·0	67·0	70·0	73·0	72·5	76·0	78·5	75·0	77·0	79·0	77·0	81·0	82·5	83·5	83·0	81·0	86·0	88·0	88·0	91·5	90·0	92·5	89·5	82·0	80·0
39924....	64·0	65·5	65·0	67·5	70·0	70·5	73·0	73·0	71·5	76·0	76·0	76·5	77·5	80·0	80·5	81·0	81·0	85·0	86·0	89·0	89·5	90·5	94·0	91·5	83·5	80·0
40734....	56·0	55·5	53·0	56·5	57·0	57·5	59·5	61·5	60·0	60·0	60·5	59·5	63·5	65·0	67·0	66·5	66·0	70·5	72·0	71·0	72·5	72·5	73·0	72·0	65·5	62·0
Total....	636·5	625·5	602·0	648·0	654·5	660·0	679·0	693·5	681·5	688·0	703·0	697·0	740·5	738·0	757·5	764·5	750·5	792·5	805·0	811·0	817·5	821·0	848·0	828·0	763·0	731·5
Average..	63·6	62·6	60·2	64·8	65·4	66·0	67·9	69·4	68·2	68·8	70·3	69·7	74·0	73·8	75·8	76·4	75·0	79·2	80·5	81·1	81·8	82·1	84·8	82·8	76·3	73·2

TABLE III. *Group III.*

39842....	67·0	67·5	66·0	71·5	69·5	70·0	72·0	75·0	73·0	78·0	80·0	80·5	81·5	82·5	84·0	86·5	84·5	87·0	88·0	88·5	83·0	92·0	90·5	92·5	80·5	76·0
39843....	56·0	51·0	51·5	50·5	54·0	50·5	52·0	56·5	57·0	56·5	58·0	57·5	62·0	63·5	65·0	61·5	63·5	64·5	65·0	65·0	65·5	66·0	65·0	63·5	56·5	51·5
39849....	65·0	59·0	58·0	60·5	62·5	62·0	64·0	64·5	65·0	61·5	64·0	65·0	65·5	66·5	64·0	64·0	63·0	67·5	68·0	68·0	66·0	67·0	68·5	64·5	58·0	51·0
39881....	60·0	54·5	59·5	63·5	64·5	66·5	70·5	70·5	68·5	73·5	73·5	75·0	76·5	76·5	79·5	80·5	77·0	82·0	82·0	84·0	86·0	87·0	85·5	85·5	80·5	90·0
39885....	72·0	68·5	68·0	72·0	73·0	71·5	72·0	76·5	78·0	75·5	76·5	79·5	85·5	87·0	87·5	89·0	81·0	87·5	89·0	89·0	92·5	94·0	95·0	93·5	85·0	82·5
39898....	61·0	62·5	61·0	62·5	65·5	64·0	66·0	66·5	65·0	64·5	67·5	64·0	69·0	66·5	Sick	Sick	65·0	65·5	68·0	69·0	72·0	70·5	74·0	73·5	63·5	62·0
39908....	55·0	55·0	55·5	57·5	57·5	59·0	60·5	61·0	62·5	63·0	63·0	62·0	64·0	65·5	67·5	67·5	66·0	70·0	69·0	72·0	73·0	72·0	72·0	67·0	56·5	55·0
39915....	69·5	68·5	65·5	73·0	69·0	73·0	75·5	74·5	79·5	80·0	79·5	82·5	85·0	87·0	89·0	87·0	89·5	94·5	95·5	99·0	100·0	100·0	104·5	105·0	95·5	91·0
40823....	65·5	66·0	66·0	69·5	68·0	71·0	73·0	74·0	76·5	77·0	78·0	78·0	81·5	84·0	86·0	83·0	83·5	87·5	90·0	89·0	90·5	93·0	93·5	93·0	83·5	82·0
40912....	64·0	61·0	58·0	60·0	62·0	60·0	61·0	65·0	65·0	64·5	67·0	66·5	72·0	70·5	72·5	70·5	70·0	72·5	74·0	74·5	76·5	75·5	75·0	73·5	64·5	63·5
Total....	635·0	613·5	609·0	640·5	645·5	647·5	666·5	684·0	690·0	694·0	707·0	710·5	742·5	759·5	696·0	689·5	743·0	779·5	788·5	798·0	811·0	817·0	823·5	811·5	724·0	694·5
Average..	63·5	61·4	60·9	64·0	64·6	64·8	66·6	68·4	69·0	69·4	70·7	71·0	74·2	76·0	77·2	76·6	74·3	78·0	78·8	79·8	81·1	81·7	82·4	81·2	72·4	69·4

WEIGHTS OF SHEEP IN POUNDS (*Continued*).

APPENDIX 1B. TABLE IV. *Group IV.* EXPERIMENT 1B.

Sheep No.	1934.				1935.																				
	7.11.	24.11.	8.12.	22.12.	4.1.	19.1.	2.2.	16.2.	2.3.	16.3.	30.3.	13.4.	27.4.	11.5.	25.5.	8.6.	22.6.	6.7.	20.7.	3.8.	17.8.	31.8.	14.9.	28.9.	12.10.	26.10.
39868....	70·0	69·5	70·0	73·0	76·5	73·5	79·5	80·0	78·5	74·5	80·0	78·0	81·5	81·0	83·5	80·5	80·5	84·0	87·0	82·0	84·0	86·0	89·0	85·5	76·0	78·0
39883....	55·0	48·5	51·0	54·5	56·0	56·0	55·0	55·0	58·0	55·5	56·0	56·0	57·5	59·0	61·0	62·0	60·5	65·5	65·5	63·5	62·5	62·5	64·0	65·5	58·5	55·0
39896....	71·0	75·0	73·5	80·0	81·5	80·0	85·0	85·5	87·5	87·0	88·5	92·5	90·0	91·0	94·5	96·5	95·0	97·5	99·5	99·0	105·0	103·0	102·5	102·5	92·0	94·0
39899....	66·5	52·5	56·0	62·0	62·5	58·5	63·5	66·5	68·0	64·5	68·5	74·0	75·0	75·0	79·5	82·0	82·0	85·5	84·5	83·0	84·0	86·5	83·0	89·0	81·5	80·5
39905....	61·0	62·0	60·0	65·5	67·0	65·5	67·0	67·0	68·0	69·0	66·5	68·0	62·5	66·5	71·0	70·0	65·0	71·5	71·5	71·0	71·5	71·5	68·0	71·5	65·0	62·5
39931....	65·0	65·0	64·0	69·0	69·5	64·0	69·5	67·0	70·5	69·0	70·0	74·0	71·0	77·5	78·5	73·0	76·5	81·5	81·0	82·5	85·0	82·5	85·5	86·0	76·0	76·0
39183....	64·0	61·0	62·0	65·5	70·0	66·5	71·5	69·5	72·5	72·5	73·5	77·0	80·0	81·5	79·5	82·5	81·5	85·0	86·5	89·0	90·0	91·5	95·0	90·5	80·0	80·5
40662....	66·0	63·0	64·5	68·0	68·0	66·0	68·5	68·5	68·5	68·0	69·5	71·0	71·0	70·5	76·0	72·0	70·5	78·0	78·0	79·0	78·0	81·5	85·0	83·5	76·5	74·0
40735....	56·0	53·5	57·5	57·0	60·5	61·5	64·0	65·0	65·5	65·5	69·0	71·5	72·0	73·0	74·5	73·0	73·5	78·0	78·0	79·5	82·0	81·0	82·0	79·5	73·5	72·0
40804....	60·5	62·5	58·5	63·5	62·5	60·5	67·0	70·0	65·5	64·5	68·5	71·0	72·5	73·0	77·5	75·0	74·5	80·0	81·5	82·0	85·5	85·0	88·0	88·5	78·0	79·5
Total.....	635·0	612·5	617·0	658·0	674·0	652·0	690·5	694·0	702·5	690·0	710·0	733·0	733·0	728·0	775·5	766·5	759·5	806·5	813·0	810·5	827·5	831·0	842·0	842·0	757·0	752·0
Average..	63·5	61·2	61·7	65·8	67·4	65·2	69·0	69·4	70·2	69·0	71·0	73·3	73·3	72·8	77·6	76·6	76·0	80·6	81·3	81·0	82·8	83·1	84·2	84·2	75·7	75·2

TABLE V. *Group V.*

39854....	56·0	61·0	61·0	60·5	61·5	62·0	64·0	68·0	64·5	67·0	64·0	64·0	65·0	62·0	69·0	69·5	69·0	70·0	69·5	75·0	74·5	70·0	73·0	74·5	67·0	67·0
39882....	71·0	72·5	76·0	75·5	72·5	71·0	79·0	78·0	73·5	71·5	73·0	72·0	71·0	71·5	81·5	74·5	73·0	77·0	71·0	75·0	71·5	71·0	70·5	71·5	65·5	64·5
39884....	65·0	72·0	73·0	71·0	68·0	75·0	70·5	76·0	71·5	72·5	73·5	71·5	73·0	69·0	76·0	79·0	79·0	77·0	77·5	75·0	83·0	78·0	77·0	77·5	69·0	70·0
39890....	66·5	75·0	77·5	72·5	75·0	79·0	74·5	77·5	74·0	76·0	76·0	75·5	71·5	67·0	75·5	71·5	74·5	73·5	75·0	72·5	77·5	69·5	74·0	73·0	67·5	64·0
39910....	61·0	69·5	71·0	67·5	70·0	72·0	72·0	73·5	67·0	71·5	70·0	64·0	68·0	63·0	69·5	71·5	68·0	72·0	72·0	69·0	62·5	63·0	68·5	66·0	58·5	58·0
39913....	71·0	79·0	80·0	75·0	78·5	79·5	76·0	81·0	Sick	76·5	75·0	73·0	77·0	71·0	78·0	85·5	81·0	84·5	83·0	84·0	83·5	82·0	83·0	85·0	73·5	76·5
39926....	64·5	72·5	73·5	71·5	72·5	72·5	72·0	77·0	73·0	72·0	72·5	71·5	73·0	70·0	74·5	76·5	76·0	76·5	73·5	81·0	75·5	72·5	72·0	71·5	63·0	64·5
40801....	55·5	60·0	62·0	60·0	59·5	57·0	56·5	60·0	58·0	58·5	59·5	60·0	59·5	57·0	62·0	64·0	63·0	65·5	64·5	64·0	63·0	57·0	62·5	60·0	57·0	53·0
40816....	66·5	72·0	74·5	73·5	71·5	70·5	73·5	76·0	74·0	72·0	72·0	70·0	71·0	65·0	73·0	72·0	68·0	68·0	69·0	72·0	67·5	61·0	70·0	68·5	62·5	62·0
40826....	60·5	71·0	72·5	73·5	72·5	74·0	73·5	76·5	74·0	73·0	76·0	77·0	74·5	70·0	75·0	74·0	73·5	74·5	74·0	74·0	72·5	67·0	70·0	68·5	72·0	62·5
Total.....	637·5	704·5	721·0	700·5	701·5	712·5	711·5	743·5	629·5	710·5	711·5	698·5	703·5	665·5	734·0	737·5	725·0	738·5	729·0	741·5	731·0	690·0	720·5	716·0	655·5	642·0
Average..	63·8	70·4	72·1	70·0	70·2	71·2	71·2	74·4	69·9	71·0	71·2	69·8	70·4	66·6	73·4	73·8	72·5	73·8	72·9	74·2	73·1	69·0	72·0	71·6	65·6	64·2

TABLES VI-X.—OESTROUS OBSERVATIONS.

APPENDIX 1B. TABLE VI. *Group I.* EXPERIMENT 1B.

Sheep No.		1934		1935										Period between commencement of testing and first oestrus observed.	Sexual Season, 1934–1935.			Period between oestrus and termination of testing.
		Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.		Periodicity of Oestrus.	Duration.	No. of dioestrous cycles.	
														days.	days.	days.	days.	
8839	Testing for oestrus commenc d on 5.11.34.	—	,24	11, 28	15,	5, 24	9,	15,	3, 21	—	—	—	—	—	50	18 17 18 18 18 17 36 19 18	180	10	132
9856		—	,19	6, 23	9, 27	,16	3, 21	8, 26	13, 30	,18	—	—	—	—	45	18 17 17 18 17 18 18 17 18 18 17 18	212	13	105
9865		—	,27	14, 30	,17	6, 24	10, 28	,16	3, 21	9, 26	14,	—	—	—	53	18 16 18 17 18 17 18 18 18 18 18 17 19	231	14	78
9895		—	—	,24	10, 26	14, 31	,16	3, 21	6, 23	—	—	—	—	—	50	17 16 16 17 16 17 18 16 17	151	10	130
9909		—	1,	6, 23	9, 26	15,	1, 18	,23	9, 26	13,	—	—	—	—	27	36 17 17 17 17 17 17 35 17 17 17	225	12	110
9920		—	10, 26	12, 29	15,	4, 22	9, 26	13, 30	,16	3, 21	7, 23	10, 26	—	—	36	16 17 17 17 17 17 18 18 17 17 17 17 18 17 16 18 16	291	18	35
9921		—	—	15, 31	,16	6, 22	7, 25	13, 29	15,	2,	—	—	—	—	72	16 16 18 16 16 18 18 16 17 17	169	11	121
9925		—	—	8, 26	14,	3, 20	6, 24	13, 31	,17	7, 25	12, 30	—	—	—	65	18 19 17 17 17 18 19 18 17 20 18 18 18	235	14	62
0614		—	—	—	—	—	,26	12,	—	—	—	—	—	—	172	16	17	2	172
0807		—	—	,27	12, 28	,17	4,	,23	8, 25	—	—	—	—	—	84	16 16 17 18 49 16 17	150	8	128

Group II.

9846	Testing for oestrus commenced on 5.11.34.	—	—	—	—	—	—	,19	6,	—	—	—	—	—	194	18	19	2	147
9859		—	—	,29	,16	6, 24	10, 29	—	4, 21	—	—	—	—	—	86	18 18 18 17 19 36 17	144	8	132
9861		—	—	—	8, 25	14,	6, 16	10,	—	—	—	—	—	—	96	17 17 23 10 24	92	6	174
9874		—	,25	,28	—	,21	7, 25	12, 25	15,	,24	—	—	—	—	51	34 52 17 18 17 13 21 39	212	9	99
9889		—	10, 27	11, 27	12,	1, 17	3, 19	5, 22	8, 24	11, 27	13,	—	—	—	36	17 15 16 16 17 16 17 16 16 17 17 16 17 16 17	247	16	79
9901		—	—	11,	14,	4, 20	5, 23	9,	13,	—	—	—	—	—	68	34 18 16 16 18 16 35	154	8	140
9916		—	3, 21	7, 25	11,	,18	5, 23	11, 28	15,	3, 21	9, 26	—	2, 21	—	29	18 17 18 17 35 18 18 18 17 18 18 18 19 17 37 19	323	17	10
9922		—	3, 21	7, 25	11, 28	,17	3,	8,	—	,17	4, 22	9,	—	—	29	18 17 18 17 17 17 17 35 70 18 18 18	281	13	52
9924		—	6, 24	11, 28	14,	3, 21	9, 26	13, 31	,18	5, 23	10, 28	15,	3, 19	—	32	18 18 17 17 17 18 19 17 17 18 18 17 18 18 18 18 18 16	318	19	12
0734		—	2, 19	5, 23	9, 26	,16	2, 20	7, 26	,30	—	4, 21	8,	—	—	28	17 17 18 17 17 18 17 18 17 19 35 35 17 18	281	15	53

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OESTROUS OBSERVATIONS (*Continued*).

APPENDIX 1B. TABLE VIII. *Group III.* EXPERIMENT 1B.

Sheep No.		1934		1935										Period between commencement of testing and first oestrus observed.	Sexual Season, 1934–1935.			Period between oestrus and termination of testing.
		Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.		Periodicity of Oestrus.	Duration.	No. of dioestrous cycles.	
															days.	days.	days.		days.
39842	Testing for oestrus commenced on 5.11.34.	—	—	10, 27	12,	, 18	4, 21	8, 26	12 29	16,	3, 20	—	—	—	67	17 16 34 17 17 17 18 17 17 17 18 17	223	13	72
39843		—	—	, 18	4, 20	9, 26	12, 28	15, 31	, 17	4, 21	—	—	—	—	75	17 16 17 17 17 16 17 16 17 17 17	185	12	102
39849		—	—	, 26	11, 28	, 16	3,	7, 24	10, 27	14, 31	—	5,	—	—	83	16 17 16 18 34 17 17 17 17 17 36	223	12	56
39881		—	5, 21	8, 26	12,	1, 19	5, 22	10, 28	—	1, 18	6, 23	9, 26	14,	—	31	17 17 18 17 17 18 17 17 18 18 34 17 19 17 17 17 18	314	18	17
39885		—	, 19	6, 23	9, 26	, 16	3, 19	6, 23	10, 27	15,	2, 21	—	—	—	45	18 17 17 17 18 18 16 17 17 18 17 18 18 19	246	15	71
39893		—	—	—	—	1,	5,	—	14,	—	—	—	—	—	117	35 70	106	3	139
39908		—	4, 22	9, 27	14,	5, 23	11, 29	—	5, 25	12, 31	, 19	—	—	—	30	18 18 18 18 19 18 19 18 37 20 17 19 19	259	14	73
39915		—	—	3,	7,	13, 30	—	4, 21	, 24	, 28	14, 30	—	—	—	60	35 34 17 35 17 34 34 17 16	240	10	62
40823		—	, 19	3, 19	4, 21	9, 26	11, 28	14, 30	, 16	2, 19	2, 20	—	—	—	45	15 16 16 17 16 17 16 17 16 16 17 16 17 14 18	245	16	72
40912		—	13, 28	14, 28	14,	, 18	3, 19	5, 21	6,	8, 23	8, 24	—	—	—	39	15 17 14 17 32 16 16 16 16 16 32 15 16 16	255	15	68

TABLE IX. *Gdoup IV.*

39868	Testing for oestrus commenced on 5.11.34.	—	—	1, 18	4,	10, 30	13,	1, 18	4, 21	9, 26	12, 29	—	—	—	58	17 17 34 20 14 18 17 17 17 18 17 17 17	241	14	63
39883		—	1, 19	—	, 25	—	—	—	—	—	—	—	—	—	27	18 68	87	3	248
39896		—	3, 20	6,	10, 28	, 17	3, 22	8, 26	12, 29	, 17	3, 20	7, 23	—	—	29	17 17 35 18 17 17 19 16 18 17 17 18 17 17 18 16	295	17	38
39899		—	—	—	11, 28	—	—	, 26	—	1, 19	—	—	—	—	99	17 87 36 18	159	5	104
39905		—	, 23	—	13,	—	5,	10, 28	—	1, 19	7,	—	—	—	49	52 51 35 18 34 18 19	228	8	85
39931		—	—	7,	—	4, 22	10, 28	15,	—	—	—	—	—	—	64	56 18 19 18 17	129	6	169
39183		—	, 20	4, 21	8,	14, 31	, 18	5, 22	9, 26	13, 30	, 17	3,	—	—	46	15 17 18 34 17 18 17 17 18 17 17 17 18 17	258	15	58
40662		—	, 19	5, 22	8, 26	14, 31	, 17	, 25	7, 24	12, 29	14,	—	—	—	45	17 17 17 18 16 17 17 38 13 17 18 17 16	239	14	78
40735		—	—	12, 28	14,	3, 20	5, 23	10, 27	12, 29	, 17	4,	—	—	—	69	16 17 17 17 16 18 17 17 16 17 18 18	205	13	88
40804		—	, 19	5, 21	7, 24	14,	—	—	—	—	, 29	—	—	—	45	17 16 17 17 18 168	254	7	63

TABLE X. *Group V.*

															days.	days.	days.		days.
39854	Testing for oestrus commenced on 5.11.34.	—	—	2, 19	—	12,	15,	3, 21	7, 26	10, 28	14,	1, 18	—	—	59	17 52 34 18 18 17 19 14 18 17 18 17	260	13	43
39882		—	—	1,	, 17	, 25	11, 27	14,	—	4,	—	—	—	—	58	47 36 17 16 17 51	135	7	119
39884		—	, 16	, 21	7, 25	—	1,	6, 23	11, 28	15,	2, 20	6,	—	—	42	36 17 18 35 35 17 19 17 17 18 18 17	265	13	55
39890		—	, 23	, 27	, 17	6, 23	9, 26	13, 30	, 16	—	—	—	—	—	49	35 21 17 17 17 17 17 17 17	176	10	137
39910		—	—	—	—	—	11, 30	, 18	, 26	—	—	—	—	—	157	19 18 39	77	4	127
39913		—	, 21	7, 24	10, 27	, 16	2, 19	7,	9, 27	13, 31	, 17	2,	6, 23	—	47	17 17 17 17 17 17 17 18 33 18 16 18 17 16 34 17	307	17	8
39926		—	—	, 29	—	5, 22	8, 25	12, 29	15,	1,	4, 21	7,	—	—	86	35 17 17 17 17 17 17 16 34 17 17	222	12	54
40801		—	, 16	5,	, 23	12,	15,	2, 19	5, 22	9, 26	12 ,30	—	—	—	42	20 49 17 34 17 17 17 17 17 17 17 18	258	13	62
40816		—	—	, 20	7, 24	—	14,;	5, 22	9, 26	14,	—	—	—	—	77	18 17 49 21 17 18 17 18	176	9	109
40826		—	, 18	, 23	9, 26	, 16	2, 19	7, 25	—	—	—	—	—	—	44	36 17 17 18 17 17 18 18	159	9	159

APPENDIX 2.

EXPERIMENT 2.

MACROSCOPIC EXAMINATION OF OVARIES.

[Groups I to VIII: Nos. (1) to (69).]

GROUP I.

Observations commenced 24th July, 1932.

Ration per capita per diem.—Maize, 4 oz.; teff hay, 2·5 lb.; lick *ad lib* (2 parts bone meal, 1 part salt).

(1) *Sheep No.* 29252.—Date slaughtered, 1st November, 1934; age, 4 years; condition, good; weight, 74·0 lb.

Sexual History.

27.7.32 to 15.8.32 (20 days): two exhibitions of oestrus.
16.8.32 to 13.2.33 (182 days): anoestrous period.
14.2.33 to 24.7.33 (161 days): ten exhibitions of oestrus.
25.7.33 to 22.2.34 (213 days): anoestrous period.
23.2.34 to 2.8.34 (161 days): ten exhibitions of oestrus.
3.8.34 to 1.11.34 (91 days): anoestrous period.

Uterus.—Weight, 22·5 gm.

Left Ovary.—Weight, 0·82 gm.; mesauresments, 1·3 by 1·3 by 0·9. cm.

The abnormally large measurement from the attached to the lateral border is due to the presence of a large Graafian follicle of 0·6 cm. in diameter. On section this Graafian follicle is found to contain a clear fluid, and the outer wall is thin. Eight small Graafian follicles of 0·1 to 0·2 cm. in diameter are present on the surface of the ovary.

No corpus luteum is seen. A few remnants of previous corpora lutea are present.

Right Ovary.—Weight, 0·63 gm.; measurements, 1·2 by 1·1 by 0·8 cm.

Six small Graafian follicles of 0·1 to 0·2 cm. are present.

No corpus luteum is seen.

No remnants of previous corpora lutea are present.

(2) *Sheep No.* 29270.—Date slaughtered, 15th August, 1934; age, 4 years; condition, fair; weight 61·0 lb.

Sexual History.

1.8.32 to 17.8.32 (17 days): two exhibitions of oestrus.
18.8.32 to 23.2.33 (190 days): anoestrous period.
24.2.33 to 22.7.33 (149 days): ten exhibitions of oestrus.
23.7.33 to 15.8.34 (389 days): anoestrous period.

No exhibition of oestrus was observed during the sexual season, February to August, 1934.

Left Ovary.—Weight, 0·70 gm.; measurements, 1·2 by 1·0 by 0·8 cm.

Two conspicuous Graafian follicles with diameters of 0·3 and 0·5 cm. are present together with several smaller ones of 0·1 to 0·2 cm. A total of six Graafian follicles can be counted.

No corpus luteum is present and no remnants of previous corpora lutea can be detected.

Right Ovary.—Weight, 0·56 gm.; measurements, 1·1 by 1·0 by 0·7 cm.

Eight Graafian follicles can be counted on the surface of the ovary; the three largest are 0·2 cm. in diameter.

There is no corpus luteum present. A slight yellowish colouration on the sectioned margin is the only indication of the presence of a remnant of a previous corpus luteum.

(3) *Sheep No.* 29325.—Date slaughtered, 4th January, 1935; age, 4 years; condition, fair; weight, 62·5 lb.

Sexual History.

24.7.32 to 14.3.33 (234 days): anoestrous period.
15.3.33 to 17.7.33 (125 days): six exhibitions of oestrus.
18.7.33 to 2.5.34 (289 days): anoestrous period.
3.5.34 to 7.8.34 (97 days): six exhibitions of oestrus.
8.8.34 to 4.1.35 (150 days): anoestrous period.

Uterus.—Weight, 20·5 gm.

Left Ovary.—Weight, 0·62 gm.; measurements, 1·5 by 1·2 by 0·7 cm.

Only four Graafian follicles can be seen on the surface of the ovary, the largest being 0·3 cm. However, on section eleven Graafian follicles can be counted; three of these are 0·3 and 0·2 cm. and the remainder 0·1 cm. and less in diameter.

No corpus luteum is present, but the remnants of four previous corpora lutea can be distinguished.

Right Ovary.—Weight, 0·63 gm.; measurements, 1·2 by 1·1 by 0·9 cm.

The Graafian follicles are very inconspicuous; three are detected, the largest of which is 0·3 cm. On section the latter is found to contain a clear fluid.

No corpus luteum is present, but the remnants of three previous corpora lutea are seen.

(4) *Sheep No.* 29328.—Date slaughtered, 7th September, 1934; age, 4 years; condition, poor; weight, 58·5 lb.

Sexual History.

24.7.32 to 21.2.33 (213 days): anoestrous period.
22.2.33 to 5.7.33 (134 days): nine exhibitions of oestrus.
6.7.33 to 13.3.34 (251 days): anoestrous period.
14.3.34 to 19.5.34 (67 days): three exhibitions of oestrus.
20.5.34 to 7.9.34 (111 days): anoestrous period.

Uterus.—Weight, 26·5 gm.

Left Ovary.—Weight, 0·58 gm.; measurements, 1·1 by 1·1 by 0·7 cm.

One large Graafian follicle is seen on the lateral border of the ovary; it measures 0·5 cm. in diameter and 0·3 cm. above the surface of the ovary. Two other Graafian follicles, measuring 0·2 and 0·3 cm. in diameter, are seen on the surface of the ovary. The largest Graafian follicle is found on section to contain a clear fluid.

No corpus luteum is present, but remnants of two previous corpora lutea are seen occurring as dark specks.

Right Ovary.—Weight, 0·66 gm.; measurements, 1·1 by 1·0 by 0·8 cm.

One Graafian follicle with a diameter of 0·3 cm. is seen while four of 0·1 cm. are also present.

No corpus luteum is present, but remnants of previous corpora lutea are seen, one occurring near the sectioned border of the ovary as a dark speck.

(5) *Sheep No.* 29340.—Date slaughtered, 7th September, 1934, age, 4 years; condition, good; weight, 80·5 lb.

Sexual History.

24.7.32 to 22.2.33 (214 days): anoestrous period.
23.2.33 to 31.5.33 (98 days): six exhibitions of oestrus.
1.6.33 to 8.2.34 (253 days): anoestrous period.
9.2.34 to 22.4.34 (73 days): two exhibitions of oestrus.
23.4.34 to 7.9.34 (138 days): anoestrous period.

Uterus.—Weight, 22·5 gm.

Left Ovary.—Weight, 0·56 gm.; measurements, 1·3 by 1·0 by 0·8 cm.

About ten Graafian follicles can be counted on the surface of the ovary, but on section fifteen are seen. The largest follicles measure 0·1 and 0·2 cm. in diameter.

No corpus luteum is present. Two remnants of previous corpora lutea are seen.

Right Ovary.—Weight, 0·72 gm.; measurements, 1·3 by 1·1 by 0·8 cm.

Fifteen Graafian follicles can readily be counted; the three largest are 0·3 cm. in diameter and they are closely situated to one another.

No corpus luteum is present, but two remnants of previous corpora lutea can be seen.

(6) *Sheep No.* 29805.—Date slaughtered, 28th December, 1934; age, 4 years; condition, good; weight, 65·0 lb.

Sexual History.

24.7.32 to 14.2.33 (206 days): anoestrous period.
15.2.33 to 8.7.33 (144 days): nine exhibitions of oestrus.
9.7.33 to 1.3.34 (236 days): anoestrous period.
2.3.34 to 10.8.34 (162 days): ten exhibitions of oestrous.
11.8.34 to 28.12.34 (140 days): anoestrous period.

Uterus.—Weight, 30·5 gm.

Left Ovary.—Weight, 0·55 gm.; measurements, 1·2 by 1·1 by 0·8 cm.

Eleven small Graafian follicles are seen, the largest is 0·1 cm. in diameter.

No corpus luteum is present, but the remnants of two previous corpora lutea can be distinguished.

Right Ovary.—Weight, 0·65 gm.; measurements, 1·3 by 1·1 by 0·8 cm.

Eight Graafian follicles can be counted on the surface of the ovary. The largest follicle is situated on the pole of the ovary, measures 0·6 cm. in diameter, and is fairly prominent. On section this follicle is found to contain a clear fluid; its outer wall is thin, the inner lower surface is pinkish in colour, but the blood vessels are not prominent.

No corpus luteum is present, but two remnants of previous corpora lutea are seen.

(7) *Sheep No.* 29815.—Date slaughtered, 27th September, 1934; age, 4 years; condition, poor; weight, 48·0 lb.

Sexual History.

24.7.32 to 7.2.33 (199 days): anoestrous period.
8.2.33 to 27.6.33 (140 days): nine exhibitions of oestrus.
28.6.33 to 5.3.34 (251 days): anoestrous period.
6.3.34 to 19.6.34 (106 days): five exhibitions of oestrus.
20.6.34 to 27.9.34 (100 days): anoestrous period.

Uterus.—Weight, 15·5 gm.

Left Ovary.—Weight, 0·51 gm.; measurements, 1·2 by 1·0 by 0·8 cm.

Eight Graafian follicles are apparent on the surface of the ovary, the largest is 0·3 cm. in diameter and the remainder are 0·1 cm. The largest follicle is not prominent.

No corpus luteum is present. Three dark spots are seen on the surface of the ovary; on section these are found to be remnants of previous corpora lutea, being dark brown in colour and 0·1 cm. in diameter.

Right Ovary.—Weight, 0·38 gm.; measurements, 1·2 by 0·8 by 0·6 cm.

Seven small Graafian follicles, measuring 0·1 cm. and less, are apparent.

No corpus luteum is present. One dark brown remnant of a corpus luteum is seen; on section it is found to measure 0·05 cm.

(8) *Sheep No.* 32476.—Date slaughtered, 22nd September, 1934; age, 3½ years; condition, fair; weight, 60·0 lb.

Sexual History.

24.7.32 to 2.3.33 (222 days): anoestrous period.
3.3.33 to 15.7.33 (135 days): fixe exhibitions of oestrus.
16.7.33 to 5.6.34 (325 days): anoestrous period.
6.6.34 to 26.6.34 (21 days): two exhibitions of oestrus.
27.6.34 to 22.9.34 (88 days): anoestrous period.

Uterus.—Weight, 21·5 gm.

Left Ovary.—Weight, 0·54 gm.; measurements, 1·4 by 1·0 by 0·7 cm.

Graafian follicles are not very apparent on the surface of the ovary, but on section eleven are counted; these are all 0·1 cm. and less in diameter.

No corpus luteum is present. The remnants of two previous corpora lutea are seen on the surface of the ovary.

Right Ovary.—Weight, 0·40 gm.; measurements, 1·3 by 0·8 by 0·6 cm.

Only three Graafian follicles are seen after section of the ovary when it is held up to the light. The largest follicle is 0·3 cm. in diameter.

No corpus luteum is present, but one brown speck, the remnant of a previous corpus luteum, is seen near the sectioned margin of the ovary.

(9) *Sheep No.* 32491.—Date slaughtered, 4th January, 1935; age, 3½ years; condition, fair; weight, 64·5 lb.

Sexual History.

24.7.32 to 15.3.33 (235 days): anoestrous period.
16.3.33 to 12.5.33 (58 days): two exhibitions of oestrus.
13.5.33 to 5.5.34 (358 days): anoestrous period.
6.5.34 to 3.8.34 (90 days): three exhibitions of oestrus.
4.8.34 to 4.1.35 (154 days): anoestrous period.

Uterus.—Weight, 21·0 gm.

Left Ovary.—Weight, 0·50 gm.; measurements, 1·4 by 0·9 by 0·7 cm.

A large Graafian follicle with a thin outer wall is seen on the pole of the ovary; it measures 0·5 cm. in diameter, and when sectioned it is found to contain a clear fluid. A total of four follicles is seen.

No corpus luteum is present. Four remnants of previous corpora lutea are seen; on section two of these are found to be dark brown specks measuring 0·05 cm. and their margins are irregular.

Right Ovary.—Weight, 0·46 gm.; measurements, 1·3 by 0·95 by 0·75 cm.

Two Graafian follicles, 0·5 cm. in diameter, are situated in close proximity on one pole of the ovary. On section both these follicles are found to contain a clear fluid. A total of three follicles is seen.

No corpus luteum is present, but the remnants of three previous corpora lutea are present.

Group II.

Observations commenced 24th July, 1932.

Ration per capita per diem.—Maize, 4 oz.; teff hay, 2·5 lb.; lick *ad lib* (salt).

(10) *Sheep No.* 35508.—Date slauhtered, 1st November, 1934; age, 4 years; condition, good; weight, 67·0 lb.

Sexual History.

24.7.32 to 16.2.33 (208 days): anoestrous period.
17.2.33 to 10.7.33 (144 days): seven exhibitions of oestrus.
11.7.33 to 21.2.34 (226 days): anoestrous period.
22.2.34 to 1.8.34 (161 days): ten exhibitions of oestrus.
2.8.34 to 1.11.34 (92 days): anoestrous period.

Uterus.—Weight, 25·5 gm.

Left Ovary.—Weight, 0·78 gm.; measurements, 1·4 by 1·3 by 0·8 cm.

The external appearance of the ovary is irregular due to the presence of twelve Graafian follicles which are situated near the surface of the ovary and which are being pressed out to some extent by a corpus luteum situated adjacent to the largest follicle which has a diameter of 0·5 cm. On section the large follicle is found to contain a clear fluid and to have a thin outer wall.

The corpus luteum present projects only slightly above the surface of the ovary. On section it is found to be almost circular in form, its diameter being 0·5 cm. The substance of the corpus luteum is light yellow in colour and it has a depression measuring 0·2 cm. in its centre. This is undoubtedly a corpus luteum I at the end of the interoestrous period, so that it is apparent that ovulation occurred without the exhibition of oestrus as oestrus was last observed on 2nd August, 1934.

Right Ovary.—Weight, 0·66 gm.; measurements, 1·4 by 1·1 by 0·6 cm.

Twelve small Graafian follicles can be counted, the largest of which is 0·2 cm.

No corpus luteum is present, but two remnants of previous corpora lutea are seen occurring as dark specks.

(11) *Sheep No.* 35509.—Date slaughtered, 12th October, 1934; age, 4 years; condition, good; weight, 74·0 lb.

Sexual History.

24.7.32 to 13.1.33 (174 days): anoestrous period.
14.1.33 to 20.6.33 (158 days): nine exhibitions of oestrus.
21.6.33 to 17.1.34 (211 days): anoestrous period.
18.1.34 to 9.7.34 (174 days): eight exhibitions of oestrus.
10.7.34 to 12.10.34 (95 days): anoestrous period.

Uterus.—Weight, 18·5 gm.

Left Ovary.—Weight, 0·68 gm.; measurements, 1·2 by 1·2 by 0·8 cm.

Five Graafian follicles are apparent; the two largest measure 0·2 cm. One of the latter on section contains a clear fluid.

No corpus luteum is present. Five small yellowish specks representing the remains of previous corpora lutea are seen.

Right Ovary.—Weight, 0·51 gm.; measurements, 1·2 by 1·0 by 0·7 cm.

A Graafian follicle measuring 0·3 cm. is present on the lateral border of the ovary; it is fairly prominent and it gives the ovary an irregular shape. A few other follicles are seen on the surface of the ovary. On section the large follicle is found to contain a clear fluid and the outer wall is thin.

No corpus luteum is present, but four remnants of previous corpora lutea are seen and on section one is found to measure 0·1 cm.

(12) *Sheep No.* 29274.—Date slaughtered, 12th October, 1934; age, 4 years; condition, good; weight, 67·0 lb.

Sexual History.

24.7.32 to 15.8.32 (23 days): one exhibition of oestrus.
16.8.32 to 3.2.33 (172 days): anoestrous period.
4.2.33 to 29.8.33 (207 days): twelve exhibitions of oestrus.
30.8.33 to 15.4.34 (229 days): anoestrous period.
16.4.34 to 10.7.34 (86 days): three exhibitions of oestrus.
11.7.34 to 12.10.34 (94 days): anoestrous period.

Uterus.—Weight, 24·0 gm.

Left Ovary.—Weight, 0·49 gm.; measurements, 1·2 by 1·0 by 0·7. cm.

Seven Graafian follicles are seen in the ovary and most of these are apparent on the surface. All the follicles are small, none exceeding 0·1 cm. in diameter.

No corpus luteum is present. The remnants of five previous corpora lutea are seen occurring as dark specks on the surface of the ovary. On section the largest of these is seen to be dark brown in colour and it extends 0·15 cm. into the substance of the ovary.

Right Ovary.—Weight, 0·63 gm.; measurements, 1·4 by 1·0 by 0·8 cm.

One large Graafian follicle 0·6 cm. in diameter is seen; it is situated on the one pole of the ovary and projects 0·3 cm. above the surface of the ovary. On section this follicle is found to contain a clear fluid and its outer wall is thin.

No corpus luteum is present. Eleven remnants of previous corpora lutea can be counted on the surface of the ovary and on section some of these are found to be only 0·05 cm.

(13) *Sheep No.* 29279.—Date slaughtered, 15th August, 1934; age, 4 years; condition, fair; weight, 63·0 lb.

Sexual History.

24.7.32 to 6.3.33 (226 days): anoestrous period.
7.3.33 to 14.5.33 (69 days): five exhibitions of oestrus.
15.5.33 to 15.8.34 (458 days): anoestrous period.

No exhibition of oestrus was observed during the sexual season February to August, 1934.

Left Ovary.—Weight, 0·39 gm.; measurements, 0·9 by 0·8 by 0·6 cm.

Six Graafian follicles can be counted, the largest of which is 0·2 cm. in diameter. Two of the follicles when sectioned contain a clear fluid.

No corpus luteum is present, but one remnant of a previous corpus luteum is seen.

Right Ovary.—Weight, 0·42 gm.; measurements, 1·0 by 0·9 by 0·6 cm.

Numerous Graafian follicles are present in the ovary, the largest of which is 0·4 cm. The latter has been sectioned and is found to contain a clear fluid. There are at least four follicles about half the size of the largest follicle; the former are situated near the surface of the ovary.

No corpus luteum is present and no remnants of corpora lutea are seen.

(14) *Sheep No.* 29335.—Date slaughtered, 21st December, 1934; age, 4 years; condition, poor; weight, 44·0 lb.

Sexual History.

24.7.32 to 3.3.33 (223 days): anoestrous period.
4.3.33 to 19.7.33 (137 days): eight exhibitions of oestrus.
20.7.33 to 26.6.34 (342 days): anoestrous period.
27.6.34 to 31.7.34 (35 days): three exhibitions of oestrus.
1.8.34 to 21.12.34 (143 days): anoestrous period.

Uterus.—Weight, 15·5 gm.

Left Ovary.—Weight, 0·59 gm.; measurements, 1·4 by 1·0 by 0·8 cm.

Only three Graafian follicles of 0·2 cm. are seen in the ovary.

No corpus luteum is present, but two remnants of previous corpora lutea are seen.

Right Ovary.—Weight, 0·74 gm.; measurements, 1·3 by 1·2 by 0·85 cm.

Several Graafian follicles can be seen on the surface of the ovary and on section eight follicles can be counted, the largest being 0·4 cm.

No corpus luteum is present, but five remnants of previous corpora lutea can be distinguished.

(15) *Sheep No.* 29341.—Date slaughtered, 28th December, 1934; age, 4 years; condition, fair; weight, 67·0 lb.

Sexual History.

24.7.32 to 4.3.33 (224 days): anoestrous period.
5.3.33 to 6.7.33 (124 days): five exhibitions of oestrus.
7.7.33 to 9.2.34 (218 days): anoestrous period.
10.2.34 to 17.7.34 (158 days): two exhibitions of oestrus.
18.7.34 to 28.12.34 (164 days): anoestrous period.

Uterus.—Weight, 40·0 gm.

Left Ovary.—Weight, 0·71 gm.; measurements, 1·4 by 1·3 by 0·8 cm.

Nine Graafian follicles can be counted, the largest of which is 0·2 cm.

The section through the ovary was made from the attached to the free border in order to section a corpus luteum which is situated near the attached border. The corpus luteum appears on the surface of the ovary as a pale prominence of 0·05 cm. above the surface and it measures 0·2 cm. across its top. On section the corpus luteum is found to measure 0·5 by 0·4 cm. The cut surface is a pale cream colour and there is a slightly darker line in the centre of the body. This is apparently a corpus luteum I. Four remnants of previous corpora lutea are seen.

Right Ovary.—Weight, 0·66 gm.; measurements, 1·3 by 1·1 by 0·8 cm.

The surface of the ovary is somewhat irregular; on section this is found to be due to the presence of a large number of Graafian follicles, fifteen are counted, which are all situated near the surface of the ovary. However, all the follicles are small, the largest being 0·15 cm.

No corpus luteum is present, but the remnants of seven previous corpora lutea can be distinguished.

(16) *Sheep No.* 29793.—Date of slaughter, 28th December, 1934; age, 4 years; condition, fair; weight, 56·5 lb.

Sexual History.

34.7.32 to 5.3.33 (225 days): anoestrous period.
6.3.33 to 10.8.33 (158 days): ten exhibitions of oestrus.
11.8.33 to 10.3.34 (212 days): anoestrous period.
11.3.34 to 26.7.34 (138 days): seven exhibitions of oestrus.
27.7.34 to 28.12.34 (155): anoestrous period.

Uterus.—Weight, 36·5 gm.

Left Ovary.—Weight, 1·40 gm.; measurements, 1·5 by 1·2 by 1·6 cm.

The abnormal shape of the ovary is due to the presence of a large Graafian follicle and a corpus luteum which are situated on either side of the attached border of the ovary.

Seven Graafian follicles are counted, the largest of which is 0·5 cm.; it is being pushed out by the corpus luteum. The largest follicle on section is found to contain a clear kuid.

The corpus luteum has a very small projecting head, but it measures 0·2 cm. across the top. The head is somewhat lighter than the surrounding body, which is pinkish and on which small blood vessels can be seen. On section the corpus luteum is found to measure 1·2 by 1·0 cm.; it is pear-shaped. The cut surface is flesh-coloured and very slightly pink. A cavity, 0·5 by 0·4 cm., is present in the centre of the body and the cavity contains a fluid. This is apparently a corpus luteum I.

Right Ovary.—Weight, 0·58 gm.; measurements, 1·3 by 1·05 by 0·7 cm.

Ten Graafian follicles, all measuring 0·1 cm. and less, are present in the ovary.

No corpus luteum is present, four remnants of previous corpora lutea are seen as dark specks.

(17) *Sheep No.* 29827.—Date slaughtered, 28th December, 1934; age, 4 years; conditon, good; weight, 73·0 lb.

Sexual History.

24.7.32 to 17.2.33 (209 days): anoestrous period.
18.2.33 to 20.8.33 (184 days): ten exhibitions of oestrus.
21.8.33 to 3.4.34 (226 days): anoestrous period.
4.4.34 to 12.8.34 (131 days): six exhibitions of oestrus.
13.8.34 to 28.12.34 (138 days): anoestrous period.

Uterus.—Weight, 24·0 gm.

Left Ovary.—Weight, 0·64 gm.; measurement, 1·2 by 1·2 by 0·7 cm.

Ten Graafian follicles can be counted; the largest is 0·2 cm.

The ovary appears to bulge on the side of the free border, but no projection is present. However, on section, a corpus luteum, measuring 0·4 by 0·4 cm., is found. The body is light yellow in colour and its margins are not well defined. This is apparently a corpus luteum I in the latter part of the interovulation period.

Right Ovary.—Weight, 0·63 gm.; measurements, 1·1 by 1·1 by 0·8 cm.

On section of the ovary, fourteen Graafian follicles can be counted, the largest being 0·4 cm.

No corpus luteum is present, but two remnants of previous corpora lutea are seen.

(18) *Sheep No.* 32480.—Date slaughtered, 21st December, 1934; age, 3½ years; condition, fair; weight, 61·0 lb.

Sexual History.

24.7.32 to 7.3.33 (227 days): anoestrous period.
8.3.33 to 25.3.33 (18 days): two exhibitions of oestrous.
26.3.33 to 18.5.34 (419 days): anoestrous period.
19.5.34 to 28.7.34 (71 days): three exhibitions of oestrus.
29.7.34 to 21.12.34 (146 days): anoestrous period.

Uterus.—Weight, 27·5 gm.

Left Ovary.—Weight, 0·6 gm.; measurements, 1·1 by 0·9 by 0·75 cm.

Eleven Graafian follicles can be counted when the sectioned ovary is held up to the light, although only seven follicles are apparent on the surface of the ovary. The largest follicle on section is found to contain a clear fluid.

A slight prominence is seen on the surface of the ovary near the scetioned border. A section made through the prominence reveals it to be a corpus luteum, measuring 0·2 by 0·2 cm. The body is very pale, almost white in colour; it is probably a corpus luteum at the end of the interovulation period or a corpus luteum of the previous interovulation period.

Right Ovary.—Weight, 0·48 gm.; measurements, 1·2 by 0·9 by 0·7 cm.

Eight Graafian follicles can be counted, the largest of which is 0·5 cm. in diamter. The latter, on section, contains a clear fluid.

No corpus luteum is present, but the remnants of six previous corpora lutea are seen occurring as dark specks.

(19) *Sheep No.* 32493.—Date slaughtered, 21st December, 1934; age, 3½ years; condition, good; weight, 74·0 lb.

Sexual History.

24.7.32 to 28.3.33 (248 days): anoestrous period.
29.3.33 (1 day): one exhibition of oestrus.
30.3.33 to 6.5.34 (403 days): anoestrous period.
7.5.34 to 15.8.34 (101 days): five exhibitions of oestrus.
16.8.34 to 21.12.34 (128 days): anoestrous period.

Uterus.—Weight, 21·0 gm.

Left Ovary.—Weight, 0·54 gm.; measurements, 1·0 by 1·2 by 0·7 cm.

Two Graafian follicles, the larger of which is 0·5 cm., are situated on the free border of the ovary, giving it an abnormal shape. On section, the larger follicle is found to contain a clear fluid. The other follicle is found to be 0·3 cm. in diameter.

No corpus luteum is present, but the remnants of nine previous corpora lutea are distinguished.

Right Ovary.—Weight, 0·46 gm.; measurements, 1·2 by 1·0 by 0·65 cm.

Five very small Graafian follicles can be counted; they vary from 0·1 cm. and less in diameter.

No corpus luteum is present, but the remnants of four previous corpora lutea occur as dark specks.

Group III.

Observations commenced, 24th July, 1932.

Ration per capital per diem.—Maize, 2·7 oz.; cotton-seed meal, 1·3 oz.; teff hay, 2·5 lb.; lick, *ad lib.* (salt).

(20) *Sheep No.* 35499.—Date slaughtered, 7th September, 1934; age, 4 years; condition, fair; weight, 68·5 lb.

Sexual History.

24.7.32 to 7.2.33 (199 days): anoestrous period.
8.2.33 to 16.4.33 (68 days): three exhibitions of oestrus.
17.4.33 to 10.5.34 (389 days): anoestrous period.
11.5.34 (1 day): one exhibition of oestrus.
12.5.34 to 7.9.34 (119 days): anoestrous period.

Uterus.—Weight, 20·5 gm.

Left Ovary.—Weight, 0·89 gm.; measurements, 1·6 by 1·1 by 0·9 cm.

Six Graafian follicles can be counted; four are 0·2 cm. and the remainder 0·1 cm. in diameter.

No corpus luteum is present, but one remnant of a previous corpus luteum is seen.

Right Ovary.—Weight, 0·88 gm.; measurements, 1·5 by 1·1 by 0·7 cm.

Four Graafian follicles, 0·1 to 0·2 cm., are present in the ovary.

No corpus luteum is present, but a few remnants of previous corpora lutea are seen.

(21) *Sheep No.* 35498.—Date slaughtered, 23rd August, 1934; age, 4 years; condition, fair; weight, 57·0 lb.

Sexual History.

24.7.32 to 22.4.33 (273 days): anoestrous period.
23. 4.33 to 14.7.33 (83 days): three exhibitions of oestrus.
15.7.33 to 23.8.34 (405 days): anoestrous period.

No exhibition of oestrus was observed during the sexual season, February to August, 1934.

Uterus.—Weight, 18·5 gm.

Left Ovary.—Weight, 0·61 gm.; measurements, 1·2 by 1·1 by 0·1 cm.

A very large number of Graafian follicles of varying sizes are present in the ovary; a total of ten is counted. The ovary has an irregular shape and although the follicles are prominent, the largest follicle is only 0·3 cm. in diameter. Several follicles are 0·1 to 0·2 cm.

In close proximity to the largest follicle is a corpus luteum which when sectioned measures 0·2 cm. in diameter. It is a light yellow colour. It is apparently a corpus luteum I at the end of an interovulation period, or the corpus luteum of the previous interovulation period.

Right Ovary.—Weight, 0·42 gm.; measurements, 1·0 by 0·9 by 0·6 cm.

Two Graafian follicles can be seen on the surface of the ovary, but on section, four smaller follicles can be seen. The largest follicle is 0·2 cm.

A corpus luteum is not present, but a few dark specks indicate the remnants of previous corpora lutea.

(22) *Sheep No.* 29258.—Date slaughtered, 1st November, 1934; age, 4 years; condition, good; weight, 89·0 lb.

Sexual History.

24.7.32 to 2.3.33 (222 days): anoestrous period.
3.3.33 to 8.7.33 (128 days): six exhibitions of oestrus.
9.7.33 to 15.3.34 (250 days): anoestrous period.
16.3.34 to 19.7.34 (126 days): five exhibitions of oestrus.
20.7.34 to 1.11.34 (105 days): anoestrous period.

Uterus.—Weight, 23·5 gm.

Left Ovary.—Weight, 0·72 gm.; measurements, 1·4 by 1·2 by 0·7 cm.

Seven small Graafian follicles are counted; the largest measures 0·15 cm.

No corpus luteum is present, but a few remnants of previous corpora lutea are seen.

Right Ovary.—Weight, 0·80 gm.; measurements, 1·4 by 1·2 by 1·0 cm.

The surface of the ovary is irregular, due to the presence of numerous Graafian follicles, two of which are 0·5 cm. On section, the latter follicles are found to contain a clear fluid.

No corpus luteum is present.

(23) *Sheep No.* 29265.—Date slaughtered, 1st November, 1934; age, 4 years; condition, fair; weight, 63·0 lb.

Sexual History.

24.7.32 to 20.2.33 (212 days): anoestrous period.
21.2.33 to 7.6.33 (107 days): four exhibitions of oestrous.
8.6.33 to 12.3.34 (278 days): anoestrous period.
13.3.34 to 28.6.34 (108 days): five exhibitions of oestrus.
29.6.34 to 12.10.34 (106 days): anoestrous period.

Uterus.—Weight, 27·5 gm.

Left Ovary.—Weight, 0·67 gm.; measurements, 1·2 by 1·1 by 0·7 cm.

Four Graafian follicles situated on the lateral border of the ovary give it an irregular shape. It is found, on section, that the largest follicles measure 0·5 and 0·3 cm. and that the more superficial follicles were being pressed out by several more deeply situated follicles.

No corpus luteum is present, but two remnants occurring as dark specks are seen.

Right Ovary.—Weight, 0·57 gm.; measurements, 1·2 by 0·9 by 0·8 cm.

Three Graafian follicles, the largest of which is 0·2 cm., are seen on the surface. On section, a few more smaller follicles are revealed.

No corpus luteum is present. Six remnants of previous corpora are counted and these are found to be 0·05 cm.

(24) *Sheep No.* 29273.—Date slaughtered, 14th September, 1934; age, 4 years; condition, poor; weight, 65·0 lb.

Sexual History.

24.7.32 to 13.2.33 (205 days): anoestrous period.
14.2.33 to 26.7.33 (163 days): nine exhibitions of oestrus.
27.7.33 to 10.5.34 (288 days): anoestrous period.
11.5.34 to 27.5.34 (17 days): two exhibitions of oestrus.
28.5.34 to 14.9.34 (110 days): anoestrous period.

Uterus.—Weight, 22·5 gm.

Left Ovary.—Weight, 0·68 gm.; measurements, 1·3 by 1·1 by 0·9 cm.

The presence of large Graafian follicles and a large number of follicles gives the ovary an irregular shape. The largest follicle is 0·6 cm. in diameter and it projects 0·2 cm. above the surface of the ovary. The next largest follicle is 0·4 cm. In addition, at least four follicles of 0·1 cm. can be distinguished on the surface of the ovary. On section, several more follicles become apparent. The largest follicle, on section, is found to contain a clear fluid.

No corpus luteum is present, but two remnants of previous corpora lutea are seen occurring as dark specks.

Right Ovary.—Weight, 0·55 gm.; measurements, 1·2 by 1·1 by 0·8 cm.

The largest Graafian follicle seen is 0·2 cm. and several of 0·1 cm. are present; a total of six follicles can be counted.

No corpus luteum is present, but a few remnants of previous corpora lutea are seen.

(25) *Sheep No.* 29283.—Date slaughtered, 7.9.34; age, 4 years; condition, good; weight, 73·0 lb.

Sexual History.

24.7.32 to 16.3.33 (236 days): anoestrous period.
17.3.33 to 15.6.33 (91 days): five exhibitions of oestrus.
16.6.33 to 29.3.34 (287 days): anoestrous period.
30.3.34 (1 day): one exhibition of oestrus.
31.3.34 to 7.9.34 (161 days): anoestrous period.

Uterus.—Weight, 19·5 gm.

Left Ovary.—Weight, 0·45 gm.; measurements, 1·2 by 1·1 by 0·7 cm.

Five Graafian follicles are apparent on the surface of the ovary. The largest follicle present in the ovary is 0·4 cm., the remainder are 0·1 to 0·2 cm. in diameter. The largest follicle has been sectioned and it contains a clear fluid.

No corpus luteum is present, but a few remnants of previous corpora lutea are seen.

Right Ovary.—Weight, 0·52 gm.; measurements, 1·2 by 1·1 by 0·8 cm.

The ovary has an irregular appearance due to the prominence of three Graafian follicles. The largest follicle is 0·4 cm. and another is 0·3 cm. in diameter; they project 0·2 cm. above the surface of the ovary. Four smaller follicles are seen. The largest follicle has been sectioned; it contains a clear fluid, its outer wall is thin and small blood-vessels can be seen in the cavity.

A corpus luteum, measuring 0·2 by 0·4 cm., is present in the ovary and it has probably caused the follicles to project by pushing them out. The corpus luteum is not apparent on the surface of the ovary, but it is readily seen on section. It has a light outer margin; the centre is a deeper yellow and a slight depression occurs in the centre of the body. Some dark specks, the remnants of previous corpura lutea, are present.

(26) *Sheep No.* 29334.—Date slaughtered, 22nd September, 1934; Age, 4 years; condition, fair; weight, 58·0 lb.

Sexual History.

24.7.32 to 19.3.33 (239 days): anoestrous period.
20.3.33 to 27.5.33 (69 days): four exhibitions of oestrus.
28.5.33 to 9.4.34 (317 days): anoestrous period.
10.4.34 to 19.6.34 (71 days): four exhibitions of oestrus.
20.6.34 to 22.9.34 (95 days): anoestrous period.

Uterus.—Weight, 18·5 gm.

Left Ovary.—Weight, 0·52 gm.; measurements, 1·2 by 1·0 by 0·8 cm.

Seven Graafian follicles can be counted on the usrface of the ovary. The two largest follicles are 0·5 and 0·3 cm. in diameter; the latter was pressed out by the former to 0·1 cm. above the surface of the ovary.

No corpus luteum is present. On section a few brown specks with indefinite margins are seen; these are remnants of previous corpora lutea.

Right Ovary.—Weight, 0·38 gm; measurements, 1·1 by 0·9 by 0·8 cm.

No Graafian follicles are apparent on the surface of the ovary. However, on section seven follicles can be counted, the largest being 0·2 cm. The latter was sectioned and it contains a clear fluid.

No corpus luteum is present. One brown spot is seen on the surface of the ovary. On section it is found to be 0·1 cm.; it is obviously a remnant of a previous corporus luteum.

(27) *Sheep No.* 32482.—Date slaughtered, 1st November, 1934; age, 3½ years; condition, fair; weight, 65·0 lb.

Sexual History.

24.7.32 to 14.3.33 (234 days): anoestrous period.
15.3.33 (1 day): one exhibition of oestrus.
16.3.33 to 1.6.34 (443 days): anoeostrous period.
2.6.34 to 9.7.34 (38 days): two exhibitions of oestrus.
10.7.34 to 1.11.34 (115 days): anoestrous period.

Uterus.—Weight, 18·5 gm.

Left Ovary.—Weight, 0·63 gm.; measurements, 1·5 by 1·0 by 0·7 cm.

Eight Graafian follicles of diameters 0·1 to 0·2 cm. are counted on the surface of the ovary and on section two larger follicles of 0·3 cm. are seen.

No corpus luteum is present, but five remnants of previous corpora lutea are seen occurring as dark brown specks of 0·1 cm.

Right Ovary.—Weight, 0·48 gm.; measurements, 1·4 by 0·9 by 0·6 cm.

The Graafian follicles in the ovary are inconspicuous; on section four small follicles measuring 0·1 cm. are seen.

No corpus luteum is present, but three remnants of previous corpora lutea are seen and on section these are found to be brownish with indefinite margins and 0·1 cm. in diameter.

(28) *Sheep No.* 32495.—Date slaughtered, 27th October, 1934; age, 3½ years; condition, good; weight, 88·0 lb.

Sexual History.

24.7.32 to 12.3.33 (232 days): anoestrous period.
13.3.33 to 3.5.33 (52 days): three exhibitions of ooestrus.
4.5.33 to 11.4.34 (343 days): anoestrous period.
12.4.34 to 31.8.34 (142 days): six exhibitions of oestrus.
1.9.34 to 27.10.34 (57 days): anoestrous period.

Uterus.—Weight, 20·5 gm.

Left Ovary.—Weight, 0·48 gm.; measurements, 1·4 by 1·0 by 0·6 cm.

A large Graafian follicle 0·5 cm. in diameter is present on the one pole of the ovary, but the follicle is not prominent. It has been sectioned and it contains a clear fluid. Two small follicles are apparent in the substance of the ovary when the latter is held up to the light.

No corpus luteum is present, but two remnants of previous corpora lutea can be distinguished on the surface of the ovary.

Right Ovary.—Weight, 0·58 gm.; measurements, 1·4 by 1·1 by 0·7 cm.

Two Graafian follicles each 0·3 cm. in diameter can be seen; both have been sectioned and they contain a clear fluid.

No corpus luteum is present. Seven dark specks, the remnants of previous corpora lutea are seen; they vary in colour from yellow to dark brown, and the largest, which is dark brown, is 0·05 cm. in diameter.

GROUP IV.

Observations commenced 24th July, 1932.

Ration per capita per diem.—(*a*) 24th July, 1932, to 1st March, 1933: Maize, 4 oz.; teff hay, 2·5 lb.; Lick, *ad lib.* (2 parts bone meal, 1 part salt). (*b*) 2 nd March, 1933 to termination: Teff hay, 3·0 lb.; Lick, *ad lib* (2 parts bone meal, 1 part salt.

(29) *Sheep No.* 29261.—Date slaughtered, 30th August, 1934; age, 4 years; condition, poor; weight, 52·0 lb.

Sexual History.

24.7.32 to 23.2.33 (215 days): anoestrous period.
24.2.33 to 28.8.33 (186 days): twelve exhibitions of oestrus.
29.8.33 to 31.12.33 (125 days): anoestrous period.
1.1.34 to 7.2.34 (38 days): two exhibitions of oestrus.
8.2.34 to 30.8.34 (204 days): anoestrous period.

Uterus.—Weight, 19·5 gm.

Left Ovary.—Weight, 0·56 gm.; measurements, 1·2 by 1·1 by 0·7 cm.

Eight Graafian follicles can be counted in the ovary, the largest is 0·3 cm. in diameter; six of the follicles can be seen on the surface of the ovary.

No corpus luteum is present. The remnant of a corpus luteum measuring 0·1 cm. is seen.

Right Ovary.—Weight, 0·53 gm.; measurements, 1 3 by 0·9 by 0·7 cm.

Several Graafian follicles can be seen on the surface of the ovary, the largest is 0·3 cm. and there are many of 0·2 and 0·1 cm. None of the follicles are prominent. The large follicle on section is found to contain a clear fluid.

No corpus luteum is present and only one remnant of a previous corpus luteum can be found.

(30) *Sheep No.* 29268.—Date slaughtered, 4th October, 1934; age, 4 years; condition, fair; weight, 64·0 lb.

Sexual History.

24.7.32 to 19.1.33 (180 days): anoestrous period.
20.1.33 to 24.7.33 (186 days): ten exhibitions of oestrus.
25.7.33 to 4.4.34 (254 days): anoestrous period.
5.4.34 to 30 7.34 (117 days): five exhibitions of oestrus.
31.7.34 to 4.10.34 (66 days): anoestrous period.

Uterus.—Weight, 21·5 gm.

Left Ovary.—Weight, 0·67 gm.; measurements, 1·5 by 1·1 by 0·8 cm.

Ten Graafian follicles can be counted on the surface of the ovary, the largest being 0·3 cm. in diameter while the remainder are 0·2 and 0·1 cm. On section another follicle measuring 0·3 cm. is seen. Some of the follicles including one of the largest have been sectioned and they contain a clear fluid.

No corpus luteum is present, but the section of the ovary reveals a brownish spot 0·1 cm. just superior to a follicle; this is a remnant of a previous corpus luteum.

Right Ovary.—Weight, 0·50 gm.; measurements, 1·3 by 1·1 by 0·7 cm.

Seven small Graafian follicles each not exceeding 0·1 cm, are seen.

No corpus luteum is present, but one remnant of a previous corpus luteum has been cut through.

(31) *Sheep No.* 29298.—Date slaughtered, 4th October, 1934; age, 4 years; condition, fair; weight, 69·0 lb.

Sexual History.

24.7.32 to 30.1.33 (191 days): anoestrous period.
31.1.33 to 27.5.33 (117 days): six exhibition of oestrus.
28.5.33 to 5.5.34 (343 days): anoestrous period.
6.5.34 to 26.6.34 (52 days): four exhibitions of oestrus.
27.6.34 to 4.10.34 (100 days): anoestrous period.

Uterus.—Weight, 23·5 gm.

Left Ovary.—Weight, 0·44 gm.; measurements, 1·3 by 1·0 by 0·7 cm.

Eight Graafian follicles can be counted, the largest being 0·2 cm. in diameter.

No corpus luteum is present. One small speck 0·05 cm., a remnant of a previous corpus luteum, is seen on the sectioned margin of the ovary.

Right Ovary.—Weight, 0·72 gm.; measurements, 1·5 by 1·1 by 0·8 cm.

Ten Graafian follicles can be counted, the largest being 0·2 cm. in diameter.

No corpus luteum is present, but the remnants of three previous corpora lutea are seen. One dull dark brown spot is found to extend 0·2 cm. into the substance of the ovary.

(32) *Sheep No.* 29306.—Date slaughtered, 4th October, 1934; age, 4 years; condition, fair; weight, 64·5 lb.

Sexual History.

26.7.32 to 13.8.32 (19 days): two exhibitions of oestrus.
14.8.32 to 6.2.33 (177 days): anoestrous period.
7.2.33 to 28.8.33 (203 days): ten exhibitions of oestrus.
29.8.33 to 24 5.34 (269 days): anoestrous period.
25.5.34 to 1.7.34 (38 days): three exhibitions of oestrus.
2.7.34 to 4.10.34 (95 days): anoestrous period.

Uterus.—Weight, 19·5 gm.

Left Ovary.—Weight, 0·60 gm.; measurements, 1·3 by 1·2 by 0·8 cm.

Six Graafian follicles can be seen, the largest of which is 0·2 cm. in diameter.

No corpus luteum is present. Five dark spots are apparent on the surface of the ovary; these are the remnants of previous corpora lutea. Three of these bodies have been sectioined; they are 0·05 to 0·1 cm.; while two are of a lightish brown colour, one is somewhat darker.

Right Ovary.—Weight, 0·75 gm.; measurements, 1·5 by 1·1 by 0·8 cm.

Nine Graafian follicles can be counted, the largest being 0·2 cm. in diameter. The follicles cut through contain a clear fluid.

No corpus luteum is present. Four remnants of previous corpora lutea can be seen on the surface of the ovary; one has been sectioned; it is dark brown in colour and measures 0·1 cm.

(33) *Sheep No.* 29309.—Date slaughtered, 27th September, 1934; age, 4 years; condition, fair; weight, 62·5 lb.

Sexual History.

29.7.32 to 4.9.32 (38 days): three exhibitions of oestrus.
5.9.32 to 11.1.33 (129 days): anoestrous period.
12.5.32 to 28 7.33 (198 days): twelve exhibitions of oestrus.
29.7.33 to 27.4.34 (273 days): anoestrous period.
28.4.34 to 20.6.34 (54 days): four exhibitions of oestrus.
21.6.34 to 27.9.34 (99 days): anoestrous period.

Uterus.—Weight, 15·5 gm.

Left Ovary.—Weight, 0·62 gm.; measurements, 1·5 by 1·0 by 0·8 cm.

Ten small Graafian follicles can be counted; only one follicle is 0·2 cm., the remainder 0·1 cm. and less in diameter.

No corpus luteum is present, and no remnants of previous corpora lutea can be seen.

Right Ovary.—Weight, 0·88 gm.; measurements, 1·6 by 1·2 by 0·9 cm.

Nineteen Graafian follicles can be counted, all of which are small, the largest being 0·2 cm.

No corpus luteum is present, and only one remnant of a previous corpus luteum can be seen; the latter is a bright yellow spot and it measures 0·05 cm.

(34) *Sheep No.* 29316.—Date slaughtered, 22nd September, 1934; age, 4 years; condition, fair; weight, 69·0 lb.

Sexual History.

24.7.32 to 26.2.33 (218 days): anoestrous period.
27.2.33 to 21.7.33 (145 days): nine exhibitions of oestrus.
22.7.33 to 15.6.34 (329 days): anoestrous period.
16.6.34 (1 day): one exhibition of oestrus.
17.6.34 to 22.9.34 (98 days): anoestrous period.

Uterus.—Weight, 24·0 gm.

Left Ovary.—Weight, 0·58 gm.; measurements, 1·4 by 1·1 by 0·7 cm.

Graafian follicles are not easily seen on the surface of the ovary, but six follicles are seen on section of the ovary, the largest being 0·2 cm. in diameter. The latter follicle has been cut through and it contains a clear fluid.

No corpus luteum is present. Seven remnants of previous corpora lutea occurring as dark specks are seen.

Right Ovary.—Weight, 0·60 gm.; measurements, 1·5 by 1·1 by 0·7 cm.

There is one large Graafian follicle, 0·4 cm. in diameter which bulges very slightly above the surface of the ovary, while five follicles of 0·1 cm. are also present. The large follicle has been cut through; it contains a clear fluid and its outer wall is thin.

No corpus luteum is present. Seven remnants of previous corpora lutea are seen; they are 0·1 cm. in diameter.

(35) *Sheep No.* 29822.—Date slaughtered, 30th August, 1934; age, 4 years; condition, poor; weight, 50·0 lb.

Sexual History.

29.7.32 (1 day): one exhibition of oestrus.
30.7.32 to 28.1.33 (183 days): anoestrous period.
29.1.33 to 20.7.33 (173 days): nine exhibitions of oestrus.
21.7.33 to 30.8.34 (406 days): anoestrous period.

No exhibition of oestrus was observed during the sexual season February to August, 1934.

Uterus.—Weight, 16·0 gm.

Left Ovary.—Weight, 0·53 gm.; measurements, 1·2 by 0·9 by 0·7 cm.

Nine Graafian follicles are seen situated near the surface of the ovary; the largest follicle is 0·3 cm. in diameter; it is not prominant.

No corpus luteum is present, but several remnants of previous corpora lutea are seen.

Right Ovary.—Weight, 0·53 gm.; measurements, 1·1 by 1·0 by 0·7 cm.

Two Graafian follicles of 0·2 cm. in diameter are seen on the surface of the ovary. On section, a follicle of 0·4 cm. is seen in addition to several small follicles varying in size.

No corpus luteum is present, but the remnants of previous corpora lutea are seen.

(36) *Sheep No.* 29825.—Date slaughtered, 14th September, 1934; age, 4 years; condition, fair; weight, 59·5 lb.

Sexual History.

24.7.32 to 21.2.33 (213 days): anoestrous period.
22.2.33 to 15.6.33 (114 days): six exhibitions of oestrus.
16.6.33 to 18.5.34 (337 days): anoestrous period.
19.5.34 (1 day): one exhibition of oestrus.
20.5.34 to 14.9.34 (118 days): anoestrous period.

Uterus.—Weight, 18·5 gm.

Left Ovary.—Weight, 0·46 gm.; measurements, 1·2 by 1·0 by 0·7 cm.

One Graafian follicle measuring 0·2 cm. is seen and three others of 0·1 cm. and less are present.

No corpus luteum is present, but six remnants of previous corpora lutea are seen as dark specks.

Right Ovary.—Weight, 0·64 gm.; measurements, 1·3 by 1·1 by 0·7 cm.

Very numerous small Graafian follicles can be seen on the surface of the ovary, and even more follicles are seen when the ovary is sectioned. A total of ten follicles is counted, the largest being 0·2 cm. in diameter.

No corpus luteum is present, and only one remnant of a previous corpus ulteum is seen.

(37) *Sheep No.* 35500.—Date slaughtered, 30th August, 1934; age, 4 years; condition, fair; weight, 66·0 lb.

Sexual History.

30.7.32 (1 day): one exhibition of oestrus.
31.7.32 to 27.1.33 (181 days): anoestrous period.
28.1.33 to 11.9.33 (227 days): twelve exhibitions of oestrus.
12.9.33 to 30.8.34 (353 days): anoestrous period.

No exhibition of oestrus was observed during the sexual season, February to August, 1934.

Uterus.—Weight, 17·5 gm.

Left Ovary.—Weight, 0·45 gm.; measurements, 1·1 by 0·9 by 0·6 cm.

One large Graafian follicle measuring 0·5 cm. is seen on the surface of the ovary and on section five small follicles 0·1 cm. are found. The large follicle has been sectioned and it contains a clear fluid.

No corpus luteum is present, but the remnants of some previous corpora lutea are seen.

Right Ovary.—Weight, 0·61 gm.; measurements, 1·2 by 1·0 by 0·7 cm.

A Graafian follicle measuring 0·4 cm. in diameter is readily seen on the surface of the ovary although it is not prominent. On section of the ovary, five smaller follicles 0·1 to 0·2 cm. are seen. The largest follicle has been cut through and it contains a clear fluid.

No corpus luteum is present, and only one remnant of a previous corpus luteum is seen.

Group V.

Observations commenced 22nd July, 1932.

Ration per capita per diem.—Maize, 5 oz.; teff hay, 2·5 lb.; Lick, *ad lib* (2 parts bone meal, 1 part salt).

(38) *Sheep No.* 35507.—Date slaughtered, 23rd August, 1934; age, aged; condition, fair; weight, 51·0 lb.

Sexual History.

22.7.32 (1 day): one exhibition of oestrus.
23.7.32 to 21.11.32 (122 days): anoestrous period.
22.11.32 to 6.9.33 (289 days): fourteen exhibitions of oestrus.
7.9.33 to 23.8.34 (351 days): anoestrous period.

No exhibition of oestrus was observed during the sexual season, February to August, 1934.

Uterus.—Weight, 32·0 gm.

Left Ovary.—Weight, 0·64 gm.; measurements, 1·4 by 1·1 by 0·6 cm.

Graafian follicles are very inconspicuous on the surface of the ovary, but on section four small follicles 0·1 cm. in diameter are seen.

No corpus luteum is present, but the remnants of previous corpora lutea are seen.

Right Ovary.—Weight, 0·53 gm.; measurements (omitted).

One Graafian follicle, 0·3 cm. is seen near the surface of the ovary; this has been sectioned and it contains a clear fluid. On section of the ovary three more follicles 0·1 cm. in diameter are seen.

No corpus luteum is present, but the remnants of several previous corpora lutea are seen.

(39) *Sheep No.* 35506.—Date slaughtered, 14th December, 1934; age, 6 years; condition, fair; weight, 61·0 lb.

Sexual History.

9.7.32 to 29.8.32 (52 days): four exhibitions of oestrus.
30.8.32 to 22.11.32 (58 days): anoestrous period.
23.11.32 to 3.8.33 (255 days): eleven exhibitions of oestrus.
4.8.33 to 26.3.34 (235 days): anoestrous period.
27.3.34 to 27.8.34 (155 days): eight exhibitions of oestrus.
28.8.34 to 14.12.34 (109 days): anoestrous period.

Uterus.—Weight, 40·0 gm.

Left Ovary.—Weight, 1·13 gm.; measurements, 1·8 by 1·4 by 0·8 cm.

Twelve Graafian follicles are seen, the largest of which is 0·1 cm; many of the follicles are hardly visible. However, on section larger follicles are seen to be situated deeper in the tissues of the ovary: one is 0·4 cm. and two are 0·25 cm. in diameter.

No corpus luteum is present and no remnants of corpora lutea are seen.

Right Ovary.—Weight, 1·22 gm.; measurements, 1·8 by 1·5 by 0·9 cm.

Ten Graafian follicles can be counted, the largest of which is 0·15 cm. A projection of 0·2 cm. on one pole of the ovary proved, on section, to be a follicle which has been pushed out; it measures only 0·3 cm. and its outer wall is thick. The largest follicle seen is 0·4 cm.

No corpus luteum or remnants of corpora lutea are seen.

(40) *Sheep No.* 15239.—Date slaughtered, 23rd August, 1934; age, 6-7 years; condition, good; weight, 74·0 lb.

Sexual History.

26.7.32 (1 day): one exhibition of oestrus.
27.7.32 to 21.2.33 (210 days): anoestrous period.
22.2.33 to 8.7.33 (137 days): nine exhibitions of oestrus.
9.7.33 to 23.8.34 (411 days): anoestrous period.

No exhibition of oestrus was observed during the sexual season, February to August, 1934.

Uterus.—Weight, 50·5 gm.

Left Ovary.—Weight, 0·66 gm.; measurements, 1·5 by 1·0 by 0·6 cm.

Graafian follicles are not very apparent on the surface of the ovary, but two follicles of 0·1 cm. are seen when the ovary is sectioned.

A corpus luteum just appearing on the surface of the ovary measures 0·2 by 0·3 cm. It apparently is a receding corpus at a late stage. A few remnants of previous corpora lutea are present.

Right Ovary.—Weight, 0·80 gm.; measurements, 1·4 by 1·2 by 0·8 cm.

Numerous Graafian follicles are seen on the surface of the ovary; one although 0·5 cm. in diameter does not project above the surface of the ovary.

Near the sectioned margin of the ovary is a corpus luteum measuring 0·2 cm. in diameter. This corpus luteum also appears to be in a late receding stage. No remnants of previous corpora lutea seen.

(41) *Sheep No.* 21658.—Date slaughtered, 7th December, 1934; age, 6 years; condition, good; weight, 81·0 lb.

Sexual History.

9.7.32 to 15.9.32 (70 days): five exhibitions of oestrus.
16.9.32 to 12.3.33 (178 days): anoestrous period.
13.3.33 to 8.9.33 (180 days): twelve exhibitions of oestrus.
9.9.33 to 6.5.34 (241 days): anoestrous period.
7.5.34 to 16.10.34 (163 days): eleven exhibitions of oestrus.
17.10.34 to 7.12.34 (52 days): anoestrous period.

Uterus.—Weight, 34·5 gm .

Left Ovary.—Weight, 0·90 gm.; measurements, 1·6 by 1·2 by 0·7 cm.

Twelve Graafian follicles can be counted in the ovary, many of which are apparent on the surface of the ovary. The largest follicle is 0·3 cm. in diameter.

No corpus luteum is present, but the remnants of six previous corpora lutea are seen occurring as light brown specks.

Right Ovary.—Weight, 0·93 gm.; measurements, 1·6 by 1·2 by 0·9 cm.

Seven Graafian follicles can be counted, the largest of which is 0·5 cm. in diameter.

No corpus luteum is present although the remnants of ten previous corpora lutea are seen.

(42) *Sheep No.* 25876.—Date slaughtered, 14th December, 1934; age, 6 years; condition, fair; weight, 58·0 lb.

Sexual History.

17.7.32 (1 day): one exhibition of oestrus.
18.7.32 to 2.1.33 (169 days): anoestrous period.
3.1.33 to 14.7.33 (193 days): nine exhibitions of oestrus.
15.7.33 to 11.3.34 (240 days): anoestrous period.
12.3.34 to 11.7.34 (62 days): seven exhibitions of oestrus.
12.7.34 to 14.12.34 (156 days): anoestrous period.

Uterus.—Weight, 27·0 gm.

Left Ovary.—Weight, 0·65 gm.; measurements, 1·5 by 1·1 by 0·75 cm.

Fourteen Graafian follicles can be counted on the surface of the ovary, they are all 0·1 cm. and less in size. On section follicles are found throughout the tissues of the ovary; the largest seen is 0·2 cm. in diameter.

No corpus luteum is present, but five remnants of previous corpora lutea are seen; one of the latter when sectioned is found to be a dark brown irregular spot of 0·1 cm.

Right Ovary.—Weight, 0·85 gm.; measurements, 1·5 by 1·3 by 0·8 cm.

Fifteen Graafian follicles can be counted, the largest of which is 0·2 cm. On section follicles are found to exist throughout the tissue of the ovary and even near the attached border.

No corpus luteum is present, but seven remnants of previous corpora lutea are seen.

(43) *Sheep No.* 25883.—Date slaughtered, 22nd September, 1934; age, 6 years; condition, poor; weight, 53·0 lb.

Sexual History.

22.7.32 to 27.8.32 (37 days): three exhibitions of oestrus.
28.8.32 to 3.11.32 (68 days): anoestrous period.
4.11.32 to 24.7.33 (263 days): ten exhibition of oestrus.
25.7.33 to 18.1.34 (178) days): anoestrous period.
19.1.34 to 13.6.34 (146 days): two exhibitions of oestrus.
14.6.34 to 22.9.34 (101 days): anoestrous period.

Uterus.—Weight, 32·5 gm.

Left Ovary.—Weight, 0·58 gm.; measurements, 1·3 by 1·1 by 0·7 cm.

One Graafian follicle 0·3 cm. in diameter is seen but it is not prominent; numerous other follicles 0·1 cm. are seen on the surface of the ovary. On section twelve follicles can be counted.

No corpus luteum is present. A few remnants of previous corpora lutea are seen as dark specks; one of these has been sectioned and is 0·1 cm.

Right Ovary.—Weight, 0·60 gm.; measurements, 1·3 by 1·1 by 0·8 cm.

One Graafian follicle only 0·2 cm. in diameter is seen projecting 0·1 cm above the surface of the ovary, and several other follicles of 0·1 cm. are present . On section it is found that the projecting follicle had been pressed out by a larger follicle, 0·6 cm. in diameter, which is situated deeper in the tissues of the ovary.

No corpus luteum is present, but about six dark specks can be counted; the latter are remnants of previous corpora lutea.

(44) *Sheep No.* 25907.—Date slaughtered, 30th November, 1934; age, 7 years; condition, poor; weight, 53·0 lb.

Sexual History.

23.7.32 to 10.8.32 (19 days): two exhibitions of oestrus.
11.8.32 to 14.2.33 (188 days): anoestrous period.
15.2.33 to 20.8.33 (187 days): nine exhibitions of oestrus.
21.8.33 to 7.4.34 (230 days): anoestrous period.
8.4.34 to 9.10.34 (185 days): nine exhibitions of oestrus.
10.10.34 to 30.11.34 (52 days): anoestrous period.

Uterus.—Weight, 34·5 gm.

Left Ovary.—Weight, 0·51 gm.; measurements, 1·1 by 1·2 by 0·6 cm.

Three Graafian follicles are seen on the surface of the ovary, each of them being 0·1 cm.

No corpus luteum is present. The ovary bulges somewhat on its lateral border. A dark brown speck 0·075 cm. is seen on the top of the bulge. On section the spot is found to be a remnant of a corpus luteum; it measures 0·1 by 0·1 cm. and is dark brown in colour. Other remnants, light brown in colour, occur in close proximity.

Right Ovary.—Weight, 0·42 gm.; measurements, 0·9 by 1·1 by 0·6 cm.

Four Graafian follicles are seen; one measures 0·5 cm. and the remainder 0·1 cm. One of the smaller follicles is superimposed on the large follicle, giving the ovary an abnormal shape.

No corpus luteum is present, but a few remnants of previous corpora lutea are seen.

Group VI.

Observations commenced 7th October, 1932.

Treatment.—On grazing; lick, *ad lib.* (2 parts bone meal and 1 part salt).

(45) *Sheep No.* 15257.—Date slaughtered, 9th November, 1934; age, 6 years; condition, fair; weight, 75·0 lb.

Sexual History.

7.10.32 to 21.2.33 (138 days): anoestrous period.
22.2.33 to 1.9.33 (192 days): eleven exhibitions of oestrus.
2.9.33 to 28.12.33 (188 days): anoestrous period.
29.12.33 to 10.8.34 (225 days): ten exhibitions of oestrus.
11.8.34 to 9.11.34 (91 days): anoestrous period.

Uterus.—Weight, 48·0 gm.

Left Ovary.—Weight, 1·66 gm.; measurements, 2·2 by 1·4 by 0·9 cm.

The ovary is seen to contain one Graafian follicle 0·4 cm. in diameter and six follicles of 0·1 cm.

A very prominent corpus luteum is present. It projects 0·4 cm. above the surface of the ovary and it measures 0·9 cm. across the top or head. The head is circular, it is flattened on top and has a very slight depression in its centre. The head is pinkish in colour. On section the corpus luteum is found to occupy fully half of the ovary; the former measures 1·2 by 1·1 cm. it is pinkish in colour, and it has no central depression.

Right Ovary.—Weight, 0 69 gm.; measurements, 1·5 by 1·2 by 0·8 cm.

Eight Graafian follicles can be counted, the largest being 0·3 cm. in diameter. The latter has been sectioned and it contains a clear fluid.

No corpus luteum is present, but the remnants of six previous corpora lutea are seen.

(46) *Sheep No.* 15327.—Date slaughtered, 11th January, 1935; age, 7 years; condition, fair; w eight, 63·5 lb.

Sexual History.

7.10.32 to 12.3.33 (157 days): anoestrous period.
13.3.33 to 10.8.33 (151 days): seven exhibitions of oestrus.
11.8.33 to 3.2.34 (177 days): anoestrous period.
4.2.34 to 5.8.34 (183 days): six exhibitions of oestrus.
6.8.34 to 11.1.35 (159 days): anoestrous period.

Uterus.—Weight, 60·5 gm.

Left Ovary.—Weight, 1·93 gm.; measurements, 1·8 by 1·9 by 1·1 cm.

The abnormal shape of the ovary is due to the presence of a large corpus luteum.

Six Graafian follicles can be counted in the ovary, the largest is 0·4 cm. The largest follicle has been sectioned; it contains a clear fluid and its outer wall is thin and transparent.

The corpus luteum does not have a projecting head, but its outer surface is pink in colour and a number of blood vessels can be seen transversing its surface. On section the corpus luteum is found to measure 1·2 by 1·1 cm. The cut surface is flesh coloured, and there is a cavity of 0·4 cm. in diameter which contains a fluid. This is apparently a corpus luteum I. Seven remnants of previous corpora lutea are seen.

Right Ovary.—Weight, 1·03 gm.; measurements, 1·5 by 1·5 by 0·7 cm.

The ovary has a shrivelled appearance. Fifteen Graafian follicles can be counted in the ovary all of which are 0·1 cm. and less in diameter.

No corpus luteum is present, and only one remnant of a previous corpus luteum can be seen.

(47) *Sheep No.* 21504.—Date slaughtered, 11th January, 1935; age, 7 years; condition, poor; weight, 57·0 lb.

Sexual History.

7.10.32 to 8.2.33 (125 days): anoestrous period.
9.2.33 to 6.6.33 (118 days): five exhibitions of oestrus.
7.6.33 to 13.5.34 (341 days): anoestrous period.
14.5.34 to 23.8.34 (102 days): five exhibitions of oestrus.
24.8.34 to11.1.35 (141 days): anoestrous period.

Uterus.—Weight, 35·5 gm.

Left Ovary.—Weight, 0·75 gm.; measurements, 1·5 by 1·1 by 0·8 cm.

Ten Graafian follicles can be counted on the surface of the ovary, the largest being 0·15 cm. However, on section of the ovary, a follicle measuring 0·5 cm. is found deeply situated in the substance of the ovary.

A projection of 0·1 cm. and measuring 0·3 cm. across its head is found on the surface of the ovary. It is pale and almost white in colour. On section it is found to be a corpus luteum measuring 0·6 by 0·6 cm. It has a central depression of 0·3 cm. and its cut surface is light flesh coloured. This is apparntly a corpus luteum I. No remnants of previous corpora lutea are present.

Right Ovary.—Weight, 0·48 gm.; measurements, 1·1 by 1·1 by 0·7 cm.

On section of the ovary eleven Graafian follicles can be counted, although eight are apparent on the surface of the ovary. The largest follicle is 0·3 cm. in diameter; it is deeply situated and it is surrounded by several other follicles.

No corpus luteum is present and no remnants of previous corpora luta are seen.

(48) *Sheep No.* 24928.—Date slaughtered, 22nd November, 1934; age, 7 years; condition, fair; weight, 72·0 lb.

Sexual History.

7.10.32 to 27.2.33 (144 days): anoestrous period.
28.2.33 to 5.8.33 (159 days): ten exhibitions of oestrus.
6.8.33 to 7.2.34 (186 days): anoestrous period.
8.2.34 to 25.9.34 (230 days): twelve exhibitions of oestrus.
26.9.34 to 22.11.34 (68 days): anoestrous period.

Uterus.—Weight, 45·0 gm.

Left Ovary.—Weight, 1·35 gm.; measurements, 1·9 by 1·4 by 0·9 cm.

Five Graafian follicles can be counted on the surface of the ovary, the largest being 0·2 cm. The ovary is soft and flabby and difficult to section. On section a follicle measuring 0·7 cm. is found lying deep in the parenchymatous layer. This follicle has been cut into and it contains a clear fluid.

No corpus lutum is present, but seventeen remnants of previous corpora lutea can be counted; the latter vary from light to dark brown in colour.

Right Ovary.—Weight, 1·2 gm.; measurements, 1·8 by 1·4 by 0·8 cm.

Eleven Graafian follicles can be counted in the ovary; the two largest follicles measure 0·3 cm. and they were found in close proximity.

No corpus luteum is present, but the remnants of six previous corpora lutea are seen.

(49) *Sheep No.* 25873.—Date slaughtered, 11th January, 1935; age, 6 years; condition, good; weight, 80·0 lb.

Sexual History.

7.10.32 to 3.3.33 (148 days): anoestrous period.
4.3.33 to 12.8.33 (162 days): nine exhibitions of oestrus.
13.8.33 to 16.2.34 (188 days): anoestrus period.
17.2.34 to 27.7.34 (161 days): ten exhibitions of oestrus.
28.7.34 to 11.1.35 (168 days): anoestrous period.

Uterus.—Weight, 41·5 gm.

Left Ovary.—Weight, 0·79 gm.; measurements, 1·5 by 1·3 by 0·8 cm.

Seven Graafian follicles can be seen in the ovary all of which are 0·1 cm. and less in diameter.

A very small projection is found on the surface of the ovary. On section of the ovary a corpus luteum is found measuring 0·3 by 0·3 cm. and the cut surfaces of the body are very pale. It is apparently a corpus luteum I during the latter part of the interovulation period. Nine remnants of previous corpora lutea are present.

Right Ovary.—Weight, 1·15 gm.; measurements, 1·6 by 1·5 by 0·9 cm.

Fifteen Graafian follicles can be counted in the ovary; there is one follicle of 0·3 cm. and three of 0·2 cm. Some follicles were cut through when the ovary was sectioned; they contained a clear fluid..

No corpus luteum is present, but the remnants of four corpora lutea are seen.

(50) *Sheep No.* 35501.—Date slaughtered, 14th December, 1934; age 7 years; condition, very good; weight, 84·0 lb.

Sexual History.

7.10.32 to 9.2.33 (126 days): anoestrous period.
10.2.33 to 27.5.33 (107 days): seven exhibitions of oestrus.
28.5.33 to 6.3.34 (283 days): anoestrous period.
7.3.34 to 4.9.34 (182 days): ten exhibitions of oestrus.
5.9.34 to 14.12.34 (101 days): anoestrous period.

Uterus.—Weight, 37·5 gm.

Left Ovary.—Weight, 0·81 gm.; measurements, 1·5 by 1·5 by 0·9 cm.

Five Graafian follicles can be counted, one of which is 0·55 cm. and the remainder very small. The largest follicle is prominent and the outer wall is transparent; it was cut into when the ovary was sectioned and it is found to contain a clear fluid.

A corpus luteum is present. It projects only 0·05 cm. above the surface of the ovary, the head measures 0·1 cm. acros its width. The colour is pale and it has a light yellow spot in its centre. On section the corpus luteum is found to be pale in colour; it measures 0·6 by 0·5 cm. It is apparently a corpus luteum I.

Right Ovary.—Weight, 0·48 gm.; measurements, 1·4 by 0·9 by 0·6 cm.

Only three Graafian follicles can be detected. The largest follicle is seen on section of the ovary; it measures 0·2 cm.

No corpus luteum is present, but the remnants of six previous corpora lutea are seen occurring as dark specks.

(51) *Sheep No.* 35496.—Date slaughtered, 30th November, 1934; age, 7 years; condition, very good; weight, 87·0 lb.

Sexual History.

7.10.32 to 23.2.33 (140 days): anoestrous period.
24.2.33 to 16.7.33 (143 days): nine exhibitions of oestrus.
17.7.33 to 17.2.34 (216 days): anoestrous period.
18.2.34 to 3.9.34 (197 days): twelve exhibitions of oestrus.
4.9.34 to 30.11.34 (88 days): anoestrous period.

Uterus.—Weight, 20·5 gm.

Left Ovary.—Weight, 0·56 gm.; measurements, 1·3 by 1·0 by 0·7 cm.

Four Graafian follicles can be seen on the surface of the ovary; they are not easily seen and the largest is 0·3 cm. The latter follicle has been cut into and it contains a clear fluid.

No corpus luteum is present, but the remnants of nine previous corpora lutea are seen.

Right Ovary.—Weight, 0·61 gm.; measurements, 1·4 by 1·0 by 0·7 cm.

Three Graafian follicles can be seen on the surface of the ovary and three more have become apparent on section of the ovary. The largest follicle occurs on the one pole of the ovary; it measures 0·5 cm. and when cut is found to contain a clear liquid.

No corpus luteum is present, but the remnants of five previous corpora lutea are seen.

(52) *Sheep No.* 35502.—Date slaughtered, 11th January, 1935; age, 6 years; condition, poor; weight, 68·0 lb.

Sexual History.

7.10.32 to 22.2.33 (139 days): anoestrous period.
23.2.33 to 1.8.33 (160 days): ten exhibitions of oestrus.
2.8.33 to 22.2.34 (205 days): anoestrous period.
23.2.34 to 27.6.34 (125 days): eight exhibitions of oestrus.
28.6.34 to 11.1.35 (198 days): anoestrous period.

Uterus.—Weight, 33·5 gm.

Left Ovary.—Weight, 0·93 gm.; measurements, 1·4 by 1·3 by 1·0 cm.

Fourteen Graafian follicles can be counted on the surface of the ovary; the largest follicle is 0·5 cm. However, when the ovary is sectioned twenty-four follicles are counted. The largest follicle has been cut into; it contains a clear fluid and its internal surfaces are pinkish.

No corpus luteum is present and three remnants of previous corpora lutea are seen.

Right Ovary.—Weight, 0·72 gm.; measurements, 1·3 by 1·1 by 0·8 cm.

The Graafian follicles present in the ovary are all small, not exceeding 0·1 cm. in diameter. On section of the ovary seven follicles can be counted.

No corpus luteum is present, but four remnants of previous corpora lutea are seen.

(53) *Sheep No.* 35497.—Date slaughtered, 30th November, 1934; age, 7 years; condition, good; weight, 95·0 lb.

Sexual History.

7.10.32 to 14.2.33 (131 days): anoestrous period.
15.2.33 to 29.8.33 (196 days): ten exhibitions of oestrus.
30.8.33 to 2.1.34 (126 days): anoestrous period.
3.1.34 to 3.9.34 (244 days): ten exhibitions of oestrus.
4.9.34 to 30.11.34 (88 days): anoestrous period.

Uterus.—Weight, 29·5 gm.

Left Ovary.—Weight, 0·65 gm.; measurements, 1·5 by 1·1 by 0·7 cm.

Eight Graafian follicles can be counted on the surface of the ovary; the largest follicle is 0·4 cm. and the remainder are 0·1 cm. in diameter.

No corpus luteum is present but four remnants of previous corpora lutea are seen.

Right Ovary.—Weight, 0·69 gm.; measurements, 1·2 by 1·2 by 0·9 cm.

Four Graafian follicles can be seen on the surface of the ovary; the largest follicle is 0·6 cm. and the remainder are 0·1 cm. in diameter. The largest follicle is found to bulge 0·15 cm. beyond the surface of the ovary. On section, it is found that this follicle is situated above another follicle of approximately the same size which was pressing the former out.

No corpus luteum is present, but a few remnants of previous corpora lutea are seen.

Group VII.

Observations commenced 7th October, 1932.

Treatment.—On grazing: Maize, 8 to 12 oz. per capita per diem; lick, *ad lib.* (2 parts bone meal, 1 part salt).

(54) *Sheep No.* 15351.—Date slaughtered, 30th November, 1934; age, 7 years; condition, good; weight, 84·0 lb.

Sexual History.

7.10.32 to 5.2.33 (122 days): anoestrous period.
6.2.33 to 31.8.33 (207 days): thirteen exhibitions of oestrus.
1.9.33 to 11.1.34 (133 days): anoestrous period.
12.1.34 to 29.10.34 (291 days): eighteen exhibitions of oestrus.
30.10.34 to 30.11.34 (32 days): anoestrous period.

Uterus.—Weight, 52·5 gm.

Left Ovary.—Weight, 0·72 gm.; measurements, 1·3 by 1·2 by 0·9 cm.

Two very inconspicuous small Graafian follicles are seen on the surface of the ovary, but on section of the ovary six small follicles are found to be present. A slight projection of 0·1 cm. above the surface of the ovary is found. It is marked with a series of concentric circles of small blood vessels which leave a small clear space in the centre. The projection measures 0·3 cm. across. When the area adjacent to the projection is touched with a pin, the projection bulges outward and it appears to enclose a liquid. When the pressure is realised, the projection returns to its original size. This is a Graakan follicle shortly before rupture.

No corpus luteum is present but a few remnants of previous corpora lutea are seen.

Right Ovary.—Weight, 0·60 gm.; measurements, 1·4 by 1·0 by 0·7 cm.

Two Graafian follicles can be seen; the larger follicle is 0·3 cm. and when cut through it contains a clear fluid.

No corpus luteum is present, but the remnants of four previous corpora lutea are seen.

(55) *Sheep No.* 22210.—Date slaughtered, 16th November, 1934; age, 6 years; condition, good; weight, 75·0 lb.

Sexual History.

7.10.32 to 2.3.33 (147 days): anoestrous period.
3.3.33 to 30.7.33 (150 days): seven exhibitions of oestrus.
31.7.33 to 9.3.34 (222 days): anoestrous period.
10.3.34 to 11.9.34 (186 days): five exhibitions of oestrus.
12.9.34 to 16.11.34 (66 days): anoestrous period.

Uterus.—Weight, 31·5 gm.

Left Ovary.—Weight, 1·2 gm.; measurements, 1·4 by 1·5 by 0·9 cm.

Twenty Graafian follicles can be counted on the surface of the ovary and the largest is 0·2 cm. On section of the ovary the parenchymatous layer is found to contain innumerable small follicles.

No corpus luteum is present. A few remnants of previous corpora lutea are seen; these are light brown in colour and they measure 0·1 cm.

Right Ovary.—Weight, 1·10 gm.; measurements, 1·5 by 1·2 by 0·7 cm.

On section of the ovary fifteen Graafian follicles can be counted, the largest being 0·3 cm.

No corpus luteum is present, but a few remnants of previous corpora lutea are seen; the latter are light brown in colour and measure 0·1 cm.

(56) *Sheep No.* 25105.—Date slaughtered, 7th December, 1934; age, 6 years; condition, very good; weight, 95·0 lb.

Sexual History.

7.10.32 to 3.3.33 (148 days): anoestrous period.
4.3.33 to 7.8.33 (157 days): six exhibitions of oestrus.
8.8.33 to 11.1.34 (157 days): anoestrous period.
12.1.34 to 19.9.34 (251 days): thirteen exhibitions of oestrus.
20.9.34 to 7.12.34 (79 days): anoestrous period.

Uterus.—Weight, 30·5 gm.

Left Ovary.—Weight, 0·82 gm.; measurements, 1·5 by 1·2 by 0·8 cm.

Seventeen Graafian follicles can be counted on the surface of the ovary, but all are small, being 0·15 cm. in diameter. On section of the ovary the follicles are found congregated near the surface of the ovary and no large follicles are found.

No corpus luteum is present, but the remnants of five previous corpora lutea are seen.

Right Ovary.—Weight, 1·79 gm.; measurements, 1·9 by 1·4 by 1·2 cm.

The surface of the ovary is irregular, due to the presence of large and numerous Graafian follicles and a corpus luteum.

A total of nineteen follicles can be counted; there are two of 0·5 cm., one of 0·3 cm., several of 0·2 cm. in diameter, and the remainder are smaller.

The corpus luteum gives the ovary an abnormal shape and in addition the former has a projecting head of 0·15 cm. above the surface of the ovary. The head measures 0·3 cm. across, it has a slight depression in its centre, and it is skin-coloured. On section of the ovary through the corpus luteum, the latter is found to occupy two-thirds of the ovary. The corpus luteum measures 1·5 by 1·55 cm. and its substance is flesh coloured; it has a central cavity of 0·4 by 0·3 cm. the colour of which is slightly deeper flesh-coloured than the surrounding luteal tissue.

Two Graafian follicles measuring 0·4 and 0·5 cm. are found situated near the corpus luteum.

(57) *Sheep No.* 25908.—Date slaughtered, 14th December, 1934; age, 7 years; condition, good; weight, 83·5 lb.

Sexual History.

7.10.32 to 13.1.33 (99 days): anoestrous period.
14.1.33 to 1.9.33 (231 days): thirteen exhibitions of oestrus.
2.9.33 to 17.12.33 (107 days): anoestrous period.
18.12.33 to 2.9.34 (259 days): fourteen exhibitions of oestrus.
3.9.34 to 14.12.34 (103 days): anoestrous period.

Uterus.—Weight, 47·5 gm.

Left Ovary.—Weight, 1·37 gm.; measurements, 1·4 by 1·8 by 1·25 cm.

The ovary has an abnormal shape which is due to a large projecting corpus luteum on the free border of the ovary.

Four Graafian follicles, all 0·15 cm. and less, are seen. On section, a follicle of 0·4 cm. is found near the base of the corpus luteum.

A corpus luteum I is present. It projects 0·6 cm. above the surface of the ovary and it is pinkish in colour. The projecting portion measures 0·7 cm. across its head; it is almost circular and has overlapping margins; a slight irregular depression is present in the centre of the head. On section, the corpus luteum is found to be a solid body measuring, 1·2 by 0·8 cm., and its cut surfaces are pinkish in colour. The remnants of eight previous corpora lutea are seen.

Right Ovary.—Weight, 0·86 gm.; measurements, 1·45 by 1·2 by 0·9 cm.

Two Graafian follicles, measuring 0·4 and 0·2 cm., are seen on the surface of the ovary. On section of the ovary, six follicles can be counted. The largest follicle has been sectioned and it contains a clear fluid.

A small light yellow body, measuring 0·15 cm., is present in the ovary. This is very apparently a corpus luteum of the previous interovulation period and hence corpus luteum II. The remnants of twelve corpora lutea can be counted.

(58) *Sheep No.* 25938.—Date slaughtered, 14th September, 1934; age, 7 years; condition, good; weight, 72·0 lb.

Sexual History.

7.10.32 to 7.2.33 (124 days): anoestrous period.
8.2.33 to 11.6.33 (124 days): three exhibitions of oestrus.
12.6.33 to 10.4.34 (303 days): anoestrous period.
11.4.34 to 15.5.34 (35 days): two exhibitions of oestrus.
16.5.34 to 14.9.34 (122 days): anoestrous period.

Uterus.—Weight, 77·5 gm.

Left Ovary.—Weight, 1·52 gm.; measurements, 1·7 by 1·6 by 1·1 cm.

The surface of the ovary is irregular, due to projecting follicles, none of which exceed 0·2 cm., but the follicles have probably been pushed out by the existing corpus luteum.

A corpus luteum projects 0·1 cm. above the surface of the ovary; the projecting head has a slightly yellow colour and it has a slight indentation. When sectioned, the corpus luteum measures 1·0 by 0·7 cm., and consequently occupies a large space in the ovary. The cut surface is light yellow. This is a corpus luteum I. A few dark specks, representing the remnants of previous corpora lutea, are seen.

Right Ovary.—Weight, 1·22 gm.; measurements, 1·6 by 1·6 by 0·9 cm.

A large Graafian follicle, measuring 0·5 cm., gives the ovary an irregular shape; this follicle projects 0·2 cm. above the surface of the ovary. Several smaller follicles can be distinguished.

No corpus luteum is present, but some remnants of previous corpora lutea are seen.

(59) *Sheep No.* 35503.—Date slaughtered, 22nd November, 1934; age, 6 years; condition, very good; weight, 99·0 lb.

Sexual History.

7.10.32 to 27.2.33 (144 days): anoestrous period.
28.2.32 to 31.8.33 (185 days): ten exhibitions of oestrus.
1.9.33 to 29.12.33 (120 days): anoestrous period.
30.12.33 to 24.8.34 (238 days): eight exhibitions of oestrus.
25.8.34 to 22.11.34 (90 days): anoestrous period.

Uterus.—Weight, 47·5 gm.

Left Ovary.—Weight, 0·60 gm.; measurements, 1·3 by 1·0 by 0·8 cm.

Four Graafian follicles can be seen on the surface of the ovary, the largest being 0·2 cm.

A corpus luteum, projecting 0·05 cm. above the surface of the ovary, is present. On section, it is found to be almost oval in shape, the points of the oval pointing towards the poles of the ovary. The body measures 0·3 by 0·5 cm., the margins are almost white in colour, while the centre is a light yellow which is extended to the projecting portion. This is apparently a corpus luteum II. Eight remnants of previous corpora lutea occur as light and dark brown specks.

Right Ovary.—Weight, 2·63 gm.; measurements, 1·9 by 1·4 by 1·7 cm.

The abnormal shape of the ovary is due to the presence of large Graafian follicles and a newly formed corpus luteum.

Two very prominent Graafian follicles are seen, one is 0·7 cm. and the other 0·3 cm. in diameter.

The abnormal shape of the ovary is largely caused by the presence of a newly formed corpus luteum I, which occupies fully two-thirds of the ovary. The large prominence is red and several blood vessels can be seen transversing it. On section, the body is found to contain a slightly dull-coloured fluid, a portion of which is jelly-like and the latter becomes diffused with blood when irritated with a pin. The walls of the body, enclosing a large cavity of 1·1 by 0·9 cm., are thick, being 0·1 cm., and the surface of the cavity is pinkish. The remnants of nine previous corpora lutea are seen.

(60) *Sheep No.* 35504.—Date slaughtered, 9th November, 1934; age, 6 years; condition, very good; weight, 98·0 lb.

Sexual History.

7.10.32 to 14.2.33 (131 days): anoestrous period.
15.2.33 to 13.8.33 (180 days): eleven exhibitions of oestrus.
14.8.33 to 1.1.34 (141 days): anoestrous period.
2.1.34 to 15.9.34 (257 days): fifteen exhibitions of oestrus.
16.9.34 to 9.11.34 (55 days): anoestrous period.

Uterus.—Weight, 49·5 gm.

Left Ovary.—Weight, 1·14 gm.; measurements, 1·6 by 1·2 by 0·9 cm.

Fifteen small Graafian follicles, the largest of which is 0·2 cm., can be counted.

A corpus luteum appears on the surface of the ovary. It projects 0·05 cm. above the surface of the ovary and measures 0·175 cm. across the top or head. On section, the corpus luteum is found to extend 0·8 cm. into the ovary and to be 0·5 cm. in width. It is almost cone-shaped and has a large central depression, measuring 0·3 by 0·5 cm., which contains a fluid. The substance of the body is flesh-coloured but the colour of the depression is deep pink.

Right Ovary.—Weight, 0·91 gm.; measurements, 1·4 by 1·3 by 0·9 cm.

Six Graafian follicles can be counted in the ovary; the largest is 0·6 in diameter and it causes the ovary to bulge somewhat.

No corpus luteum is present, but the remnants of four previous corpora lutea are seen.

GROUP VIII.

Observations commenced 1st May, 1933.

Treatment.—On grazing: Green oat grazing during winter months; lick, *ad lib* (2 parts bone meal, 1 part salt).

(61) *Sheep No.* 21500.—Date slaughtered, 9th November, 1934; age, 6 years; condition, very good; weight, 84·0 lb.

Sexual History.

1.5.33 to 15.9.33 (138 days): eight exhibitions of oestrus.
16.9.33 to 31.12.33 (107 days): anoestrous period.
1.1.34 to 2.10.34 (275 days): seventeen exhibitions of oestrus.
3.10.34 to 9.11.34 (38 days): anoestrous period.

Uterus.—Weight, 45·5 gm.

Left Ovary.—Weight, 0·87 gm.; measurements, 1·6 by 1·1 by 0·8 cm.

Twelve Graafian follicles can be counted in the ovary; all the follicles are small and do not exceed 0·2 cm.

No corpus luteum is present, but nine remnants of previous corpora lutea can be seen.

Right Ovary.—Weight, 1·53 gm.; measurements, 1·4 by 1·2 by 1·4 cm.

The abnormal shape of the ovary is due to the presence of large Graafian follicles and a corpus luteum.

Two large Graafian follicles, measuring 0·8 and 0·5 cm. in diameter, are seen, and in addition several smaller follicles are present. The largest follicle has been cut into; it contains a clear fluid, its outer wall is thin, and its internal surfaces are reddish in colour.

A corpus luteum is present. It projects 0·6 cm. above the surface of the ovary and measures 0·5 cm. across its head. The external portion is pinkish in colour. On section, the substance of the body is dark flesh-coloured. It measures 1·2 by 1·0 cm. and there is a central depression. The remnants of three previous corpora lutea are seen.

(62) *Sheep No.* 22059.—Date slaughtered, 14th December, 1934; age, 6 years; condition, very good; weight, 87·0 lb.

Sexual History.

3.5.33 to 10.7.33 (69 days): five exhibitions of oestrus.
11.7.33 to 31.12.33 (174 days): anoestrous period.
1.1.34 to 4.9.34 (247 days): fourteen exhibitions of oestrus.
5.9.34 to 14.12.34 (101 days): anoestrous period.

Uterus.—Weight, 39·5 gm.

Left Ovary.—Weight, 0·72 gm.; measurements, 1·2 by 1·0 and 0·8 cm.

Eleven Graafian follicles can be counted in the ovary; the largest follicle is 0·4 cm.

No corpus luteum is present, but ten remnants of previous corpora lutea are seen.

Right Ovary.—Weight, 1·13 gm.; measurements, 1·4 by 1·5 by 1·0 cm.

The ovary has an abnormal shape due to the presence of a corpus luteum.

Four small Graafian follicles, the largest of which is 0·15 cm., are present.

The corpus luteum causes the ovary to bulge. The bulge is a slight pink colour. On section, the corpus lueteum is found to occupy fully two-thirds of the ovary; the former measures 1·2 by 0·9 cm. and it is almost pear-shaped. The cut surface of the body is pink and there is no depression present. This is apparently a corpus luteum I.

(63) *Sheep No.* 25025.—Date slaughtered, 21st December, 1934; age, 6 years; condition, very good; weight, 97·0 lb.

Sexual History.

3.5.33 to 12.7.33 (71 days): five exhibitions of oestrus.
13.7.33 to 6.1.34 (178 days): anoestrous period.
7.1.34 to 11.7.34 (186 days): twelve exhibitions of oestrus.
12.7.34 to 21.12.34 (163 days): anoestrous period.

Uterus.—Weight, 47·5 gm.

Left Ovary.—Weight, 1·35 gm.; measurements, 1·7 by 1·5 by 1·0 cm.

Fourteen Graafian follicles can be counted in the ovary; the largest follicle is 0·4 cm. However, on section, a deeply seated follicle, measuring 0·6 cm., is exposed.

No corpus luteum is present and no remnants of previous corpora lutea are seen.

Right Ovary.—Weight, 1·16 gm.; measurements, 1·7 by 1·6 by 0·9 cm.

The ovary is almost completely cone-shaped, the attached border of the ovary being the base of the cone. The abnormal shape of the ovary is due to the presence of a corpus luteum.

Ten Graafian follicles can be counted in the ovary; they are 0·1 cm. and less in diameter.

The corpus luteum projects 0·2 cm. above the surface of the ovary; the projection is very bright red in colour; it measures 0·4 cm. across its top and a small irregular depression is present. On section, the corpus luteum is found to measure 0·7 by 0·6 cm.; its cut surface is very bright pink and very soft. A small indefinitely outlined depression is present in the centre of the body. This is apparently a recently formed corpus luteum I. The remnants of two previous corpora lutea are seen.

(64) *Sheep No.* 35708.—Date slaughtered, 22nd November, 1934; age, 7 years; condition, very good; weight, 83·0 lb.

Sexual History.

2.5.33 to 6.6.33 (36 days): three exhibitions of oestrus.
7.6.33 to 23.1.34 (231 days): anoestrous period.
24.1.34 to 5.8.34 (194 days): eleven exhibitions of oestrus.
6.8.34 to 22.11.34 (109 days): anoestrous period.

Uterus.—Weight, 40·0 gm.

Left Ovary.—Weight, 0·97 gm.; measurements, 1·6 by 1·2 by 0·8 cm.

Nine Graafian follicles are counted, the largest of which is 0·3 cm. in diameter.

No corpus luteum is present, but four remnants of previous corpora lutea are seen, and they are found to be irregular light brown specks, measuring 0·05 to 0·1 cm.

Right Ovary.—Weight, 1·05 gm.; measurements, 1·5 by 1·2 by 0·9 cm.

Fifteen Graafian follicles can be counted in the ovary; the largest follicles are 0·5 and 0·3 cm, but the majority are 0·1 and 0·2 cm. in diameter. The largest follicle bulges slightly above the surface of the ovary. This follicle has been cut through and it is found to contain a clear fluid.

No corpus luteum is present, but a few remnants of previous corpora lutea are seen.

(65) *Sheep No.* 35732.—Date slaughtered, 16th November, 1934; age, 6 years; condition, good; weight, 74·0 lb.

Sexual History.

2.5.33 to 10.7.33 (70 days): five exibitions of oestrus.
11.7.33 to 20.2.34 (225 days): anoestrous period.
21.2.34 to 24.7.34 (154 days): ten exhibitions of oestrus.
25.7.34 to 16.11.34 (115 days): anoestrous period.

Uterus.—Weight, 30·5 gm.

Left Ovary.—Weight, 0·60 gm.; measurements, 1·4 by 1·0 by 0·8 cm.

Eleven Graafian follicles can be counted in the ovary; the largest follicle is 0·3 cm.

No corpus luteum is present, but five remnants of previous corpora lutea are seen, occurring as dark brown specks.

Right Ovary.—Weight, 0·71 gm.; measurements, 1·3 by 1·2 by 0·8 cm.

Eight Graafian follicles can be counted in the ovary, the largest follicle being 0·3 cm. in diameter. The latter has been cut through and it contains a clear fluid.

No corpus luteum is present. Six remnants of previous corpora lutea are seen and above one of these is a small projection above the surface of the ovary. On section, the remnant is found to extend only 0·075 cm. into the substance of the ovary.

(66) *Sheep No.* 35994.—Date slaughtered, 7th December, 1934; age, 6 years; condition, very good; weight, 100·0 lb.

Sexual History.

3.5.33 to 10.8.33 (100 days): seven exhibitions of oestrus.
11.8.33 to 12.2.34 (186 days): anoestrous period.
13.2.34 to 18.9.34 (218 days): twelve exhibitions of oestrus.
19.9.34 to 7.12.34 (80 days): anoestrous period.

Uterus.—Weight, 37·0 gm.

Left Ovary.—Weight, 0·84 gm.; measurements, 1·4 by 1·3 by 0·8 cm.

Seven Graafian follicles can be counted on the surface of the ovary, but on section, a total of twelve follicles is apparent. The largest follicle measures 0·3 cm. in diameter.

No corpus luteum is present, but six remnants of previous corpora lutea are seen.

Right Ovary.—Weight, 0·89 gm.; measurements, 1·5 by 1·2 by 0·9 cm.

One Graafian follicle, measuring 0·6 cm. in diameter, is very conspicuous; it projects 0·15 cm. above the surface of the ovary, and delicate blood vessels can be seen transversing its thin outer wall. A total of nine follicles can be counted in the ovary.

No corpus luteum is present, but four remnants of previous corpora lutea are seen.

(67) *Sheep No.* 37058.—Date slaughtered, 4th January, 1935; age, 7 years; condition, good; weight, 83·0 lb.

Sexual History.

2.5.33 to 3.9.33 (125 days): eight exhibitions of oestrus.
4.9.33 to 3.1.34 (122 days): anoestrous period.
4.1.34 to 9.9.34 (249 days): fifteen exhibitions of oestrus.
10.9.34 to 4.1.35 (117 days): anoestrous period.

Uterus.—Weight, 56·5 gm.

Left Ovary.—Weight, 0·75 gm.; measurements, 1·5 by 1·05 by 0·8 cm.

Five Graafian follicles are seen, the largest of which is 0·15 cm.

A blood-red spot occurs on the surface of the ovary. The section of the ovary has been made through this spot, which is found to contain a somewhat thick and slightly yellow fluid in a small cavity. The sectioned area is marked by the presence of a diffusion of blood and numerous small blood vessels can be seen.

A very dark black spot, measuring 0·1 cm., is seen near the above object. The former object when pricked is found to contain blood. This is a case of follicular haemorrhage.

No corpus luteum and no remnants of previous corpora lutea are present.

Right Ovary.—Weight, 0·74 gm.; measurements, 1·5 by 1·1 by 0·8 cm.

Four Graafian follicles can be counted in the ovary, the largest of which is 0·4 cm. The largest follicle has been cut through and it contains a clear fluid.

Two dark black spots are seen on the surface of the ovary. On section of the ovary, they are found to resemble the black spot found in the left ovary; the largest spot measures 0·2 cm.

A corpus luteum is present; it measures 0·5 by 0·3 cm. When sectioned its shape is irregular and its margins are indefinite. The cut surface of the body is light yellow in colour. It is apparently a corpus luteum I. The remnants of three previous corpora lutea are present.

(68) *Sheep No.* 37059.—Date slaughtered, 9th November, 1934; age, 6 years; condition, very good; weight 89·0 lb.

Sexual History.

1.5.33 to 27.8.33 (119 days): eight exhibitions of oestrus.
28.8.33 to 24.12.33 (119 days): anoestrous period.
25.12.33 to 30.9.34 (280 days): eleven exhibitions of oestrus.
1.10.34 to 9.11.34 (40 days): anoestrous period.

Uterus.—Weight, 51·5 gm.

Left Ovary.—Weight, 0·99 gm.; measurements, 1·5 by 1·4 by 1·0 cm.

A large projecting Graafian follicle gives the ovary an abnormal shape. This follicle is 0·7 cm. in diameter and it projects 0·4 cm. above the surface of the ovary. In addition, three follicles, 0·1 cm., are present. The large follicle has been cut into; it contains a clear fluid and its inner wall is pinkish in colour.

A corpus luteum is present. It projects 0·5 cm. above the surface of the ovary, and its exposed head is 0·1 cm. in diameter. On section of the body, it is found to be almost circular in shape with a diameter of 0·5 cm. A central depression is present; the cut surface is skin-coloured while the cavity is reddish. Six remnants of previous corpora lutea are present in the ovary.

Right Ovary.—Weight, 0·61 gm.; measurements, 1·4 by 1·0 by 0·8 cm.

Six small Graafian follicles, measuring 0·1 cm., are present in the ovary.

No corpus luteum is present, but seven remnants of previous corpora lutea are seen.

(69) *Sheep No.* 37061.—Date slaughtered, 4th January, 1934; age, 6 years; condition, very good; weight, 102·0 lb.

Sexual History.

4.5.33 to 13.7.33 (71 days): four exhibitions of oestrus.
14.7.33 to 16.1.34 (187 days): anoestrous period.
17.1.34 to 18.9.34 (245 days): fifteen exhibitions of oestrus.
19.9.34 to 4.1.35 (108 days): anoestrous period.

Uterus.—Weight, 47·0 gm.

Left Ovary.—Weight, 1·41 gm.; measurements, 1·65 by 1·3 by 1·1 cm.

Ten Graafian follicles can be counted in the ovary; there are two follicles of 0·4 cm., one of 0·3 cm., and the remainder are 0·1 cm. and less in diameter. On section of the ovary, the largest follicle is found to be 0·5 cm.; it has a thin wall and tranversing blood vessels are seen.

A corpus luteum is present and it has caused the abnormal shape of the ovary. The corpus luteum forms only a very small prominence on the surface of the ovary. The prominence is pinkish-yellow, and surrounding it the area is more pink and small blood vessels can be seen. On section, the corpus luteum measures 1·0 by 0·9 cm.; the cut surface is pale pink and a small irregular depression, measuring 0·2 cm., is present. This is a corpus luteum I. Two remnants of previous corpora lutea are present.

Right Ovary.—Weight, 0·63 gm.; measurements, 1·2 by 1·15 by 0·7 cm.

Nine Graafian follicles can be counted in the ovary, the largest is 0·2 cm.

No corpus luteum is present, but five remnants of previous corpora lutea are seen.

APPENDIX 3.

EXPERIMENT 4.

TABLES I AND II.—WEIGHTS OF SHEEP IN POUNDS.

TABLE I.

Group II.

Sheep No.	1933.						1934.								
	12.10.	27.10.	9.11.	25.11.	19.12.	23.12.	6.1.	20.1.	2.2.	17.2.	3.3.	17.3.	29.3.	14.4.	28.4.
25914	83·5	84·0	88·5	88·0	80·5	85·0	86·5	87·5	91·0	91·0	90·0	92·5	90·5	92·5	90·0
22031	79·5	86·5	90·0	87·0	83·0	87·5	89·0	88·0	90·0	87·0	83·5	89·0	86·5	91·0	93·0
22035	73·0	75·5	76·5	78·5	67·0	75·0	77·5	74·5	79·5	81·0	80·5	80·5	80·0	79·5	77·0
35610	72·0	72·5	79·0	75·5	71·0	74·0	76·0	75·0	81·0	77·5	79·0	79·5	75·0	79·0	76·5
35659	72·5	76·5	83·5	75·5	73·0	72·5	83·0	85·0	89·5	86·0	86·5	86·0	—	80·5	79·0
35701	70·5	73·0	75·0	71·5	65·0	68·0	74·0	71·5	77·5	72·0	77·5	77·0	77·0	72·0	77·5
35741	62·5	65·0	69·0	64·0	58·0	62·5	65·5	65·5	67·5	69·0	68·0	68·0	68·0	65·0	66·0
35755	76·5	84·0	85·5	79·0	81·0	85·0	86·0	83·0	89·0	89·5	91·5	92·5	89·5	90·5	91·0
35978	80·0	84·5	85·5	86·5	83·0	85·0	88·0	89·0	94·5	87·0	91·0	91·0	91·0	93·0	93·0
Totals	670·0	701·5	732·5	705·5	661·5	694·5	725·5	719·0	759·5	740·0	747·5	756·0	647·5	743·0	743·0
Averages	74·4	77·9	81·4	78·4	73·5	77·2	80·6	79·9	84·4	82·2	83·1	84·0	80·9	82·6	82·6

TABLE II.

Group III.

18449	—	—	82·5	78·5	74·0	75·5	78·5	76·5	87·5	80·5	82·0	87·0	84·0	86·0	87·5
35628	—	—	90·5	84·0	72·0	79·0	77·0	73·0	76·5	73·5	76·5	76·5	76·0	77·0	78·5
35656	—	—	74·5	68·0	62·0	61·5	66·5	63·0	65·5	67·0	66·0	65·5	65·0	66·5	66·0
35706	—	—	76·0	67·5	61·5	64·0	63·5	64·5	72·5	71·0	72·0	69·5	72·0	73·5	75·0
35712	—	—	71·0	68·0	63·5	64·5	68·5	67·5	71·5	70·5	68·5	73·0	71·5	73·5	71·0
35731	—	—	71·5	67·5	67·0	65·5	71·0	64·5	71·0	69·5	67·0	70·0	66·0	67·5	66·5
35734	—	—	72·0	69·5	60·0	68·0	63·0	62·0	65·5	62·5	63·0	63·0	62·5	63·5	64·5
38518	—	—	79·0	80·0	76·0	77·5	77·5	79·0	84·0	84·5	87·5	88·0	86·0	91·0	88·0
38521	—	—	76·0	73·5	67·0	66·5	68·0	68·0	68·5	70·0	68·0	69·5	70·0	70·0	69·0
Totals	—	—	633·0	666·5	603·0	612·0	633·5	618·0	662·5	649·0	650·5	662·0	653·0	668·5	666·0
Averages	—	—	77·0	74·0	67·0	68·0	70·0	68·7	73·6	72·1	72·3	73·6	72·6	74·3	74·0

THE SEXUAL ACTIVITY OF BREEDING EWES.

TABLE III.

APPENDIX 3. *Group II.* EXPERIMENT 4.

Sheep No.	Date of lambing.	Occurrences of oestrus. 1933. Sept.	Oct.	Nov.	Dec.	1934. Jan.	Feb.	Mar.	April.		May.	June.	Remarks.
25914..	2.9.33	—	—	5,	14,	1, 19	5, 23	13, 30	, 17		—	—	—
22031..	8.9.33	—	—	—	—	13,	1, 19	9,	14,		—	—	—
22035..	17.9.33	—	—	—	—	3, 19	6, 23	12, 30	, 17		—	—	—
35610..	22.9.33	—	—	—	—	—	, 18	, 25	12, 29		—	—	—
35659..	8.9.33	—	—	—	—	—	—	1, 19	4,		—	—	—
35701..	18.9.33	—	—	—	—	—	—	—	—	Observations discontinued 30.4.34.	10,27	12,	Observations extended.
35741..	7.9.33	—	—	—	—	—	7, 25	—	4, 22		—	—	—
35755..	18.9.33	—	—	—	—	, 19	4, 21	10, 28	14,		—	—	—
35078..	29.9.33	—	—	—	10, 27	12,	15,	5, 21	8, 24		—	—	—

TABLE IV.

Group III.

Sheep No.	Date of lambing.	Occurrences of oestrus. 1933. Sept.	Oct.	Nov.	Dec.	1934. Jan.	Feb.	Mar.	April.	May.	June.	Remarks.
18449.....	20.9.33	—	—	—	—	—	11,	1, 18	5, 22	—	—	—
35628.....	9.9.33	—	—	—	—	—	, 16	, 28	—	—	—	—
35656.....	2.9.33	—	—	—	—	—	—	—	—	—	—	Slaughtered, 15.8.34.
35706.....	13.9.33	—	—	—	—	—	—	—	—	—	—	Slaughtered, 22.6.34.
35712.....	29.9.33	—	—	—	—	—	—	13, 29	, 16	—	—	—
35731.....	10.9.33	—	—	—	—	—	—	—	—	—	—	Slaughtered, 22.6.34.
35734.....	2.9.33	—	—	—	—	—	, 22	11, 27	12, 28	—	—	—
38518.....	20.9.33	—	—	—	—	5, 23	10, 28	, 18	6,	—	—	—
38521.....	28.9.33	—	—	—	—	—	—	, 18	, 22	—	—	—

APPENDIX 3A.

EXPERIMENT 4.

THE EXAMINATION OF THE OVARIES OF INACTIVE SHEEP.

(1) *Sheep No.* 35656.—Date slaughtered, 15th August, 1934; age, 8 years; condition, poor; weight, 66·0 lb.; date of lambing, 1st September, 1933.

Sexual History.—No exhibition of oestrus was observed during the period 2nd September, 1933, to 15th August, 1934 or 347 days.

Left Ovary.—Weight, 0·89 gm.; measurements, 1·8 by 1·2 by 0·7 cm.

Several Graafian follicles are seen, two of which are prominent, with diameters of 0·5 cm., and the remainder small, measuring 0·1 to 0·2 cm. The two large follicles have been cut through and they contain a clear fluid.

No corpus luteum is present and no remnants of previous copora lutea are seen.

Right Ovary.—Weight, 0·48 gm.; measurements, 1·4 by 0·9 by 0·7 cm.

Numerous Graafian follicles are seen on the surface of the ovary, the three largest are 0·2 cm. in diameter.

No corpus luteum is present and no remnants of previous copora lutea are seen.

(2) *Sheep No.* 35706.—Date slaughtered, 22nd June, 1934; age, 6 years; condition, good; weight, 75·0 lb.

Sexual History.—No exhibition of oestrus was observed during the period 13th September, 1933, to 22nd June, 1934, or 352 days.

Left Ovary.—Weight, 0·55 gm.; measurements, 1·5 by 1·0 by 0·7 cm.

One prominent Graafian follicle measuring 0·4 cm. in diameter is present; the follicle projects 0·2 cm. above the surface of the ovary. A second follicle of 0·2 cm. is seen in close proximity to the large follicle.

No corpus luteum is present. The remnants of several previous corpora lutea are seen occurring as dark specks.

Right Ovary.—Weight, 0·97 gm.; measurements, 1·7 by 1·0 by 0·9 cm.

Only one small Graafian follicle of 0·1 cm. is seen.

A cone shaped corpus luteum, red in colour and measuring 1·0 by 0·9 cm. is present. It is a corpus luteum (1). Several remnants of previous corpora lutea are seen.

(3) *Sheep No.* 35731.—Date slaughtered, 22nd June, 1934; age, 6 years; condition, fair; weight, 66·5 lb.

Sexual History.—No exhibition of oestrus was observed during the period 10th September, 1933, to 22nd June, 1934, or 355 days.

Left Ovary.—Weight, 0·56 gm.; measurements, 1·5 by 1·0 by 0·7 cm.

Two Graafian follicles are seen, the larger is 0·3 cm. in diameter.

No corpus luteum is present, but the remnants of several previous corpora lutea are seen.

Right Ovary.—Weight, 0·60 gm.; measurements, 1·2 by 1·2 by 0·7 cm.

Two Graafian follicles are seen, the larger of which is 0·15 cm.

No corpus luteum is present, but several remnants of previous corpora lutea are seen occurring as dark specks.

APPENDIX 4.

EXPERIMENT 5.

TABLES I AND II.—WEIGHTS OF SHEEP IN POUNDS.

TABLE I. *Group I.*

Sheep No.	1933.																1934.									
	25.5.	8.6.	23.6.	6.7.	21.7.	4.8.	18.8.	31.8.	15.9.	28.9.	12.10.	27.10.	9.11.	25.11.	9.12.	23.12.	6.1.	20.1.	2.2.	17.2.	3.3.	17.3.	29.3.	14.4.	28.4.	12.5.	29.5.
29860	108·0	105·5	100·5	94·0	86·5	85·5	81·5	80·0	83·5	86·0	90·5	90·5	99·0	93·5	102·0	106·0	111·5	111·5	116·0	113·5	115·0	117·5	118·0	118·0	117·0	115·5	105·5
29946....	107·5	106·5	102·0	98·0	90·5	89·0	84·5	81·5	84·5	87·0	93·5	98·5	101·0	101·0	107·0	108·0	111·5	111·0	115·0	116·5	118·0	118·0	115·0	119·5	114·0	117·0	110·5
29958....	114·0	110·0	104·5	98·5	92·5	92·5	89·0	88·5	89·0	88·5	93·0	99·0	100·0	107·0	108·5	109·5	117·0	116·0	121·0	119·5	120·5	124·0	124·5	126·0	123·5	124·0	125·0
30020....	104·0	104·0	95·5	90·0	83·5	80·0	74·5	77·5	79·0	80·5	86·5	86·0	91·0	94·0	101·5	103·0	110·5	110·0	118·0	118·5	117·0	119·5	120·0	121·5	123·0	122·5	116·0
30033....	103·5	100·5	96·0	88·5	86·5	84·5	78·0	81·5	76·0	81·0	90·0	91·0	100·5	99·5	107·0	103·5	110·5	112·0	118·0	110·0	121·0	116·0	117·5	121·0	121·0	112·0	113·0
30067....	112·5	109·0	103·0	96·0	101·5	98·0	94·5	88·5	90·0	96·0	95·5	103·0	107·5	108·5	112·0	115·0	122·0	120·0	125·0	123·0	121·0	129·0	128·0	129·5	130·0	131·0	130·5
32367....	113·5	111·5	105·0	101·5	94·5	90·5	84·5	86·5	85·5	90·0	96·0	96·5	100·5	104·0	108·0	115·0	118·5	115·5	121·5	122·0	126·5	126·5	126·0	129·0	126·0	122·0	121·0
32390....	102·0	97·0	91·5	89·5	82·0	76·5	71·5	71·5	74·5	78·5	85·5	90·0	91·5	91·0	99·0	102·5	109·0	108·5	115·5	113·5	116·0	117·5	117·5	118·5	120·0	117·5	115·0
38079....	92·5	90·5	85·5	80·5	74·5	70·5	66·5	66·5	64·5	65·5	72·0	72·5	77·5	74·0	75·5	82·5	86·5	85·5	86·5	86·0	86·5	88·5	88·0	90·0	89·0	85·5	80·0
38080....	117·0	112·5	112·5	104·5	105·5	101·0	93·5	93·5	93·0	95·0	102·5	107·5	112·0	114·5	120·0	125·0	129·5	130·0	136·5	134·5	—	131·0	128·0	133·0	126·0	128·0	120·5
Totals....	1074·5	1047·0	996·0	941·0	897·5	868·0	818·0	815·5	819·5	848·0	905·0	934·0	980·5	987·5	1040·5	1070·0	1126·5	1120·0	1173·0	1157·0	1041·5	1189·5	1172·5	1216·0	1189·5	1175·0	1137·0
Averages.	107·4	104·7	99·6	94·1	89·8	86·8	81·8	81·6	82·0	84·8	90·5	93·4	98·0	98·8	104·0	107·0	112·6	112·0	117·3	115·7	115·7	119·0	117·2	121·6	119·0	117·5	113·7

TABLE II. *Group II.*

35155....	61·5	59·0	57·0	56·5	54·0	49·0	49·5	51·5	52·5	56·0	57·5	58·5	63·5	62·5	62·5	69·0	74·5	69·5	76·0	75·0	80·0	81·0	79·5	82·5	82·0	81·0	80·5
35158....	59·0	56·5	55·5	55·0	52·5	51·5	51·0	50·5	52·5	57·0	59·5	61·0	65·0	60·5	63·0	66·0	69·0	66·5	75·0	72·5	70·0	72·5	73·5	73·0	76·5	73·0	74·0
35159....	56·5	53·5	52·0	51·5	50·0	47·5	46·0	44·5	48·5	52·0	53·5	56·0	58·5	59·5	55·0	59·0	60·5	62·0	62·0	66·5	65·5	67·0	68·0	73·0	67·5	68·5	68·5
35197....	62·0	62·5	60·5	61·5	58·5	57·0	52·0	52·5	51·5	55·0	57·0	60·0	65·0	64·5	65·5	68·5	72·0	70·5	72·0	75·5	76·5	77·5	76·0	75·5	76·5	79·5	77·5
35210....	48·0	48·0	47·0	47·0	45·0	43·0	43·5	44·0	45·0	49·0	51·5	53·5	59·5	57·5	58·5	63·5	64·0	62·5	67·0	68·5	70·0	70·0	70·0	71·5	69·5	71·0	69·5
35216....	51·0	50·5	48·0	47·0	43·0	43·0	40·5	41·5	42·5	49·5	50·5	55·5	58·0	62·0	60·0	66·0	69·0	70·5	71·5	72·5	76·0	74·0	72·0	75·0	76·0	77·0	74·5
35217....	62·5	61·0	57·0	56·5	51·5	50·0	48·0	50·5	50·0	54·0	58·0	59·5	62·0	62·5	65·5	67·0	70·5	68·5	74·5	71·0	75·5	76·5	75·0	79·0	81·0	78·5	77·5
35219....	60·0	58·0	56·5	56·0	54·5	54·0	53·0	53·5	56·5	60·0	63·5	64·5	69·0	71·0	66·0	72·5	74·5	72·0	75·0	76·5	77·0	78·5	76·0	77·0	80·0	78·5	77·0
35223....	54·5	52·5	50·0	49·0	46·0	43·5	43·0	43·5	46·5	50·0	53·5	55·5	62·0	60·0	65·0	70·5	74·0	68·5	78·5	80·0	79·0	82·5	82·0	85·0	83·0	80·5	81·0
35238....	46·5	44·5	43·0	42·0	40·5	37·5	37·0	38·5	39·5	45·0	47·5	48·5	53·5	52·0	54·0	57·0	60·0	58·0	59·5	60·5	62·0	63·0	61·0	65·0	64·0	63·0	61·0
Totals....	561·5	546·0	526·5	522·0	495·5	476·0	463·5	470·5	495·0	527·5	552·0	572·5	616·0	612·0	615·0	659·0	688·0	662·5	711·0	718·5	731·5	742·5	733·0	756·5	756·0	750·5	741·0
Averages.	56·2	54·6	52·6	52·2	49·6	47·6	46·4	47·0	48·5	52·8	55·2	57·2	61·6	61·2	61·5	65·9	68·8	66·8	71·1	71·8	73·2	74·2	73·3	75·6	75·6	75·0	74·1

OESTROUS OBSERVATIONS AND THE SEXUAL SEASONS OF CROSSBRED SHEEP.

APPENDIX 4. TABLE III. *Group I.* EXPERIMENT 5.

Sheep No.		1933. May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	1934. Jan.	Feb.	Mar.	April.	29th May.	Sexual season (1933), May to August. Periodicity of oestrus in days.	No. of dioestrous cycles.	Anoestrous period (1933–34), September to January. (Days.)	Sexual season (1934), February to May. Periodicity of oestrus in days.	No. of dioestrous cycles.
39860....	Oestrous observations commenced on 24.5.33.	, 25	11, 27	12, 31	—	—	—	—	—	—	, 21	10, 25	10, 26	12, 28	17 16 15 19	5	205	17 15 16 16 16 16	7
29946....		—	5, 20	, 23	—	—	—	—	—	—	—	11, 27	12, 27	12, 28	15 33	3	231	16 16 15 15 16	6
29958....		, 24	10, 27	14, 31	, 18	—	—	—	—	—	—	—	3, 20	7, 24	17 17 17 17 18	6	228	17 17 17	4
30020....		, 24	10, 27	15,	—	—	—	—	—	—	, 22	10, 27	13, 30	, 16	17 17 18	4	222	16 17 17 17 16	6
30033....		, 29	15,	1, 18	—	—	—	—	—	—	—	8, 25	9, 25	12, 28	17 16 17	4	233	17 15 16 17 16	6
30067....		—	7, 23	10, 28	—	—	—	—	—	—	, 23	12, 30	, 18	5, 21	16 17 18	4	210	17 18 19 17 16	6
32367....		—	1, 17	3, 19	4,	—	—	—	—	—	—	7, 23	8, 24	10, 27	16 16 16 16	5	215	16 16 16 16 17	6
32390....		—	7, 24	12,	—	—	—	—	—	—	—	15,	, 16	2, 18	17 18	3	246	32 16 16	4
38079....		, 25	9, 25	12, 29	—	—	—	—	—	—	—	, 17	1, 17	2, 18	15 16 17 17	5	231	15 16 15 16	5
38080....		, 24	8, 25	12,	—	—	—	—	—	—	—	10, 26	11, 27	13, 29	15 17 17	4	241	16 16 16 16 16	6

TABLE IV. *Group II.*

35155....	Oestrous observations commenced on 24.5.33.	—	—	—	—	—	—	—	—	—	—	4,	, 25	—		0	284+	52	2
35158....		, 31	—	—	—	—	—	—	—	7, 26	11, 28	, 17	3, 21	8,		1	221	19 16 17 17 17 18 17	8
35159....		—	—	—	—	—	—	—	—	1,	—	, 16	—	9, 28		0	222+	74 54 19	4
35197....		, 28	15,	2, 19	—	—	—	—	—	—	2, 19	9, 27	13, 30	, 17	18 17 17	4	198	17 18 18 17 17 17	7
35210....		—	—	—	—	—	—	—	—	—	20, 27	, 16	3, 20	8, 26,		0	262+	17 17 18 17 18 18	7
35216....		, 25	—	—	—	—	—	—	6,	13, 30	, 17	7, 24	12, 29	17,		1	195	38 17 18 18 17 19 17 18	9
35217....		, 25	—	—	—	—	—	—	—	1, 18	5, 24	12, 29	—	3, 21		1	221	17 18 19 16 17 35 18	8
35219....		—	—	—	—	—	—	—	—	—	1, 18	8, 26	13, 30	19,		0	253+	17 18 18 18 17 19	7
35223....		—	—	—	—	—	—	—	—	, 22	8, 25	14,	, 18	4,		0	230+	17 17 17 35 16	6
35238....		—	—	—	—	—	—	—	—	—	—	9, 27	, 16	3, 21		0	289+	18 20 17 18	5

TABLE V.* *Group III.*

15257....	Oestrous observations commenced on 24.5.33.	—	3, 20	8, 27	—	1,	—	—	, 29	, 15	, 19	9, 26	12,	15,	17 18 19 36	5	118	17 35 18 17 17 33	7
15327....		—	3,	7, 25	10,	—	—	—	—	—	4, 20	9,	—	—	34 18 16	4	177	16 17	3
21504....		—	6,	—	—	—	—	—	—	—	—	—	—	14,	— — —	1	341	— —	1
21607....		, 27	13, 30	, 17	3	Died 3 0.9.33.									17 17 17 17	5	—	— —	—
24928....		, 26	13,	1, 19	5,	—	—	—	—	—	8, 26	, 16	2, 19	, 24	18 18 18 17	5	186	18 18 17 17 35	6
25873....		, 31	, 18	6, 24	12	—	—	—	—	—	, 17	6, 24	11, 29	, 17	18 18 18 19	5	188	17 18 18 18 18	6
35501....		, 27	—	—	—	—	—	—	—	—	—	7, 27	13, 30	, 18	— — — —	1	283	20 17 17 18	5
35496....		, 24	11, 28	, 16	—	—	—	—	—	—	, 18	8, 26	12, 29	, 17	18 17 18	4	216	18 18 17 17 18	6
35502....		—	8, 26	14,	1,	—	—	—	—	—	, 23	12, 30	, 17	4, 22	18 18 18	4	205	17 18 18 17 18	6
35497....		—	1, 19	8,	12, 29	—	—	—	—	3, 19	6,	13, 30	—	4, 21	18 19 35 17	5	126	16 18 35 35 17	7

* NOTE.—The records of Group III have been extracted from Experiment I, Appendix 1, Table XIV.

APPENDIX 5.

EXPERIMENT 6.

TABLES I–IV.—WEIGHTS OF SHEEP IN POUNDS.

TABLE I.

Group I.—(Border Leicester-Merino Crossbreds, 1933).

Sheep No.	Date of birth.	Weight at birth.	Weights at: 3 months.	6 months.	9 months.	12 months.	15 months.	18 months.	21 months.	24 months.
38320.....	21.9.33	8·5	31·0	50·0	45·0	47·0	52·5	54·0	62·5	61·5
38321.....	8.9.33	9·0	39·5	55·5	53·5	52·0	67·0	67·0	83·0	90·0
38342.....	30.8.33	8·0	46·5	62·0	50·5	57·0	64·5	72·5	79·5	90·5
38374.....	11.9.33	8·5	45·5	62·0	50·0	63·0	71·5	76·5	81·5	82·0
38385.....	14.9.33	9·0	44·5	61·0	55·0	67·0	78·5	82·0	84·0	86·5
38399.....	17.9.33	8·0	39·0	52·0	40·0	48·0	64·5	65·0	73·0	77·0
38400.....	11.9.33	7·5	34·0	49·0	37·0	45·5	57·5	58·5	61·5	63·0
38427.....	23.9.33	11·0	43·5	63·5	56·5	69·5	81·0	80·0	87·0	91·5
38430.....	24.9.33	9·0	38·5	55·0	49·5	56·5	66·5	67·0	—	—
38436.....	24.9.33	9·5	40·5	61·5	60·0	59·0	66·5	76·0	—	—
Totals.....		88·0	402·5	571·5	497·0	564·5	650·0	699·0	612·0	642·0
Averages.....		8·8	40·2	57·2	49·7	56·4	65·0	69·9	76·5	80·2

TABLE II.

Group II.—(Merinos, 1933).

38347.....	2. 9.33	8·0	32·5	40·5	35·0	58·5	64·0	68·0	75·0	77·5
38349.....	3. 9.33	8·5	31·5	38·5	32·0	51·0	47·0	45·5	46·0	44·0
38351.....	1. 9.33	8·5	39·0	46·0	39·0	55·0	55·5	57·5	55·5	51·0
38361.....	10. 9.33	8·5	41·5	54·5	46·0	60·0	66·0	66·0	76·0	74·5
38404.....	13. 9.33	8·0	35·5	42·0	35·0	38·5	52·5	55·0	52·5	53·5
38406.....	11. 9.33	8·5	28·5	41·0	35·5	53·0	54·5	52·0	51·5	53·0
38450.....	25. 9.33	9·0	37·5	53·0	47·0	52·0	58·5	61·0	67·5	66·0
38469.....	1.10.33	7·0	24·5	41·5	36·0	43·0	51·0	55·5	53·0	62·0
38479.....	5.10.33	8·0	32·0	54·5	49·5	60·5	62·0	62·5	64·0	65·0
38536.....	17.10.33	9·0	28·0	42·0	37·0	49·0	55·0	53·0	54·5	54·5
Totals.....		83·0	330·5	453·5	392·0	520·5	566·0	576·0	595·5	601·0
Averages.....		8·3	33·0	45·4	39·2	52·0	56·6	57·6	59·6	60·1

TABLE III.

APPENDIX 5. EXPERIMENT 6.

Group III.—(Border Leicester-Merino Crossbreds, 1934).

Sheep No.	Date of births.	Weight at birth.	Weights at:			
			3 months.	6 mon hs.	9 months.	12 months.
		lb.	lb.	lb.	lb.	lb.
41241	9.9.34	10·0	51·0	58·5	55·0	44·5
41247	11.9.34	7·5	38·5	44·0	45·5	44·0
41255	12.9.34	9·0	40·5	54·0	50·0	47·5
41258	13.9.34	7·0	35·0	54·0	54·0	53·5
41259	5.9.34	9·5	50·0	64·0	70·0	68·0
41304	20.9.34	10·0	40·5	55·0	55·5	57·0
41316	7.9.34	9·5	39·0	54·0	50·5	49·5
41329	9.9.34	10·0	40·0	51·0	49·0	52·5
41337	28.9.34	9·5	42·0	60·5	64·0	61·5
41362	8.9.34	9·0	27·5	45·5	45·5	48·5
Totals		91·0	404·0	542·5	539·0	527·0
Averages		9·1	40·4	54·2	53·9	52·7

TABLE IV.

Group IV.—(Merinos, 1934).

41275	16.9.34	9·5	35·5	39·5	37·0	34·0
41276	17.9.34	8·5	32·5	35·5	41·5	46·0
41295	19.9.34	10·5	32·0	37·0	35·5	37·0
41311	22.9.34	7·5	36·0	37·5	41·0	33·0
41383	6.10.34	10·5	36·0	48·0	49·0	50·5
41349	1.10.34	9·0	34·0	44·5	45·0	41·0
41394	10.10.34	10·0	28·5	41·0	47·5	50·0
41605	11.10.34	8·5	33·5	41·5	44·5	45·5
41614	12.10.34	9·5	34·0	46·0	57·5	62·5
41616	12.10.34	9·0	36·5	41·5	50·5	54·0
Totals		92·5	338·5	412·0	449·0	435·5
Averages		9·2	33·8	41·2	44·9	45·4

APPENDIX 6.

EXPERIMENT 7.

TABLES I–VIII.—WEIGHTS OF SHEEP IN POUNDS.

Group I.

Sheep No.	1935.																
	23.3.	30.3.	13.4.	27.4.	11.5.	25.5.	8.6.	22.6.	6.7.	20.7.	3.8.	17.8.	31.8.	14.9.	28.9.	12.10.	26.10.	9.11.
41629	41·0	43·0	44·5	44·5	38·0	41·5	44·0	44·0	45·5	44·0	46·0	44·0	44·0	44·5	47·0	40·5	38·0	42·5
41641	49·5	51·5	50·5	50·0	47·5	52·5	54·0	50·5	55·0	53·5	55·0	56·0	54·5	53·5	57·5	48·5	46·0	51·0
41647	35·0	38·0	37·0	38·0	35·5	37·0	36·0	36·5	39·0	38·0	42·5	35·5	34·0	36·0	38·0	32·0	31·0	37·0
41648	44·5	46·5	45·5	47·0	44·5	45·5	44·0	44·0	45·5	44·0	46·0	46·0	40·0	42·5	45·5	39·0	38·5	43·0
42393	41·5	43·0	42·5	42·0	40·5	42·5	43·5	42·0	42·0	43·5	44·5	43·0	42·5	45·0	46·5	38·0	39·0	43·0
42394	43·0	45·5	46·0	45·5	45·0	46·0	45·5	48·0	48·0	47·5	54·5	46·5	53·0	51·5	52·0	46·0	44·0	48·0
42396	39·0	42·0	43·0	44·5	42·0	45·0	44·5	45·0	46·0	45·5	48·0	46·0	44·0	44·5	47·0	39·5	40·5	43·0
42397	44·5	47·5	47·0	47·5	44·0	48·5	49·5	49·0	50·0	49·0	51·5	47·5	49·0	47·5	50·0	43·0	41·0	45·5
42398	43·0	45·5	44·0	46·0	42·0	45·5	45·5	45·0	45·5	43·0	47·0	42·0	43·0	41·0	43·5	36·0	37·0	42·0
42399	39·0	40·0	40·5	41·5	38·5	40·5	42·5	43·0	44·0	42·5	45·0	42·0	41·5	39·0	41·0	33·5	31·5	37·0
Totals	420·0	442·5	440·5	446·0	417·5	444·5	449·0	447·0	460·5	450·5	480·0	448·5	445·5	445·0	468·0	396·0	386·5	432·0
Averages	42·0	44·2	44·0	44·6	41·8	44·4	44·9	44·7	46·0	45·0	48·0	44·8	44·5	44·5	46·8	39·6	38·6	43·2

TABLE II. *Group II.*

41624	39·0	40·0	43·5	44·5	47·5	50·5	52·5	52·0	56·5	58·0	60·5	63·0	66·5	69·5	70·5	64·0	65·5	70·0
41625	41·0	42·5	44·0	45·5	47·0	49·0	51·0	52·0	57·0	57·5	61·0	64·0	65·5	67·5	70·5	64·0	67·0	68·0
41630	36·5	39·5	42·5	46·5	49·0	50·0	51·5	53·0	56·0	57·0	60·0	61·5	65·5	65·0	65·0	57·5	58·5	63·5
41632	44·5	43·5	47·0	48·0	51·0	52·0	52·0	51·5	55·5	56·0	57·0	57·5	60·5	63·0	65·0	58·5	69·5	64·0
41639	42·0	43·0	45·0	49·5	52·0	50·5	52·0	52·5	57·5	59·0	62·0	62·0	68·0	69·0	69·5	60·5	63·0	66·0
41640	43·0	46·0	50·5	51·5	54·0	55·5	58·5	57·5	61·0	60·0	64·5	65·0	69·5	68·5	68·5	58·5	60·5	66·5
41642	41·5	44·0	43·5	46·5	49·0	50·0	50·0	50·0	54·5	57·0	60·0	61·5	66·5	68·0	71·5	66·0	68·0	70·0
41650	46·0	46·5	48·5	52·0	54·0	55·5	58·0	58·0	65·0	68·0	70·0	70·5	75·0	78·0	79·5	69·0	72·0	76·5
41652	42·5	42·0	43·0	47·0	46·5	48·0	51·0	51·0	57·0	58·5	61·5	62·5	68·0	70·0	65·5	63·5	65·0	67·5
42395	39·0	42·0	41·5	44·0	46·0	46·0	49·0	47·5	53·0	54·0	58·0	57·0	62·5	63·0	64·0	52·0	55·0	60·0
Totals	415·0	429·0	448·5	474·0	496·0	507·0	525·5	525·0	573·0	585·0	614·5	624·5	667·5	681·5	689·5	623·5	644·0	672·0
Averages	41·5	42·9	44·8	47·4	49·6	50·7	52·5	52·5	57·3	58·5	61·4	62·4	66·7	68·2	69·0	61·4	64·4	67·2

WEIGHTS OF SHEEP IN POUNDS—(*continued*).

APPENDIX 6. EXPERIMENT 7.

TABLE III. *Group III.*

Sheep No.	1935.																	
	23.3.	30.3.	13.4.	27.4.	11.5.	25.5.	8.6.	22.6.	6.7.	20.7.	3.8.	17.8.	31.8.	14.9.	28.9.	12.10.	26.10.	9.11
41623.....	41·0	40·5	45·0	47·0	50·5	51·0	53·0	52·5	58·5	60·0	63·0	62·0	66·5	69·5	70·5	62·5	68·0	70·0
41626.....	41·5	43·5	44·5	47·5	49·0	49·5	51·5	53·0	54·0	57·5	61·5	63·5	67·0	69·5	69·0	58·0	62·0	67·0
41627.....	43·5	45·0	48·5	50·5	53·0	53·0	56·0	55·0	59·0	59·0	61·0	65·5	67·5	69·0	71·5	63·0	63·5	67·5
41628.....	39·5	40·5	41·5	44·5	46·5	47·0	49·0	49·0	51·0	51·0	54·5	56·0	58·5	60·5	59·5	52·5	56·5	59·0
41635.....	45·0	47·0	48·5	51·5	55·0	55·5	57·0	57·0	62·0	62·0	64·5	66·0	69·0	70·0	72·5	61·5	65·5	69·5
41638.....	37·0	39·0	41·5	45·5	47·5	50·0	52·5	52·5	56·0	57·0	57·5	59·0	62·0	62·5	65·0	58·0	60·0	60·0
41644.....	45·5	43·5	45·5	47·5	51·0	51·5	54·0	53·5	56·5	57·0	59·5	60·5	64·5	66·0	65·0	59·5	62·0	64·5
41645.....	42·5	40·5	44·0	46·0	50·0	49·5	51·0	51·5	56·0	57·5	58·0	62·0	64·5	65·0	66·0	60·0	60·0	62·5
41649.....	44·0	45·5	48·5	50·0	53·0	52·5	56·5	55·0	59·5	61·0	64·5	63·5	69·0	71·0	71·5	65·5	67·0	70·5
42392.....	38·5	39·5	41·5	44·0	46·5	47·0	48·5	50·0	53·5	55·5	58·5	57·0	62·0	68·0	68·0	59·0	60·5	65·0
Totals.....	418·0	424·5	449·0	474·0	502·0	503·5	529·0	529·0	566·0	577·5	602·5	615·0	650·5	671·0	678·5	599·5	625·0	655·5
Averages.....	41·8	42·4	44·9	47·4	50·2	50·4	52·9	52·9	56·6	57·8	60·2	61·5	65·0	67·1	67·8	60·0	62·5	65·6

TABLE IV. *Group IV.*

41633.....	42·0	44·5	46·5	48·5	51·0	50·5	53·0	53·5	58·0	61·0	63·0	61·5	66·0	66·0	67·5	61·0	60·5	65·0
41634.....	44·0	47·0	50·0	55·0	56·0	56·5	60·0	62·5	66·0	69·5	70·5	70·0	73·5	76·0	77·5	70·5	71·0	76·0
41636.....	37·0	40·5	42·5	46·0	47·0	48·5	50·5	51·5	54·5	57·5	59·0	60·5	63·0	65·0	66·5	60·0	62·0	66·0
41637.....	40·5	42·0	45·0	47·5	49·0	50·0	52·5	56·0	61·0	62·5	64·0	68·0	69·0	71·0	69·5	62·0	67·0	69·5
41631.....	44·0	46·0	48·0	52·5	54·0	54·5	56·5	59·5	64·0	66·0	67·5	67·0	70·5	73·0	73·0	63·5	66·0	68·5
41643.....	38·0	41·0	43·0	46·5	49·0	48·5	50·5	52·0	57·0	58·5	59·0	58·5	62·0	63·0	63·5	58·0	59·0	61·5
41646.....	45·0	47·5	53·5	57·5	62·0	61·0	66·0	67·5	75·0	78·0	80·5	82·0	87·0	90·0	89·5	79·5	83·0	85·5
41651.....	45·0	47·5	51·0	53·5	57·5	57·5	61·5	62·5	69·5	71·0	75·5	76·5	79·0	81·5	83·0	74·5	77·5	80·0
42390.....	43·5	47·0	49·5	50·0	53·0	52·5	56·5	56·0	60·5	64·0	64·0	64·0	67·0	68·0	68·5	60·0	61·5	64·0
42391.....	39·5	43·5	46·0	47·0	50·0	47·5	50·5	53·5	55·5	59·0	61·5	63·0	69·5	71·5	72·5	66·5	69·0	71·5
Totals.....	418·5	446·0	475·0	504·0	528·5	521·0	557·5	574·5	621·0	657·0	664·5	671·0	709·5	725·0	733·0	655·5	666·5	707·5
Averages.....	41·9	44·6	47·5	50·4	52·8	52·7	55·8	57·5	62·1	65·7	66·4	67·1	70·9	72·5	73·3	65·6	66·6	70·8

WEIGHTS OF SHEEP IN POUNDS—(*continued*).

Table V.

Appendix 6. *Group V.* Experiment 7.

Sheep No.	23.7.35.	21.8.35.	18.9.35.	23.10.35.	7.11.35.
M. 1	58·0	60·0	58·0	60·5	51·0
M. 2	70·0	72·0	73·0	73·0	61·5
M. 3	69·0	71·5	70·5	78·0	69·5
M. 4	57·5	62·0	62·5	66·5	59·0
M. 5	61·0	65·5	62·5	65·5	54·5
M. 6	64·5	69·0	65·0	66·5	57·0
M. 7	71·5	74·0	74·0	79·5	74·0
M. 8	61·5	65·5	63·5	68·0	58·0
M. 9	63·5	65·5	65·5	70·0	61·5
M. 10	57·5	61·0	59·0	62·5	55·0
Totals	634·0	666·0	653·5	690·0	601·0
Averages	63·4	66·6	65·4	69·0	60·1

Table VI.

Group VI.

Sheep No.	25.3.35.	22.4.35.	20.5.35.	18.6.35.	16.7.35.	12.8.35.	9.9.35.	7.10.35.	4.11.35.
3	39·0	40·0	40·0	42·5	44·0	47·5	52·5	54·5	49·5
4	43·5	47·0	48·5	50·5	52·5	55·5	59·5	60·5	55·5
6	42·5	48·5	49·0	52·5	54·0	57·0	63·0	65·0	59·5
9	47·0	52·0	50·5	58·0	61·5	66·0	71·0	75·0	68·0
13	38·5	44·0	47·0	52·5	57·5	62·5	66·5	71·0	65·0
17	40·5	44·0	41·0	43·5	46·5	51·5	53·5	56·0	51·5
18	42·5	44·0	43·5	49·0	52·5	55·5	56·5	60·0	54·0
21	40·5	42·0	39·0	43·0	47·0	51·0	53·0	59·0	54·5
25	36·5	39·0	38·5	42·0	44·5	48·5	53·0	55·0	52·0
29	41·5	44·0	45·0	49·0	50·5	53·0	57·0	60·5	58·0
Totals	412·0	444·5	442·0	482·5	510·5	548·0	585·5	615·5	567·5
Averages	41·2	44·4	44·2	48·2	51·0	54·8	58·6	61·6	56·8

WEIGHTS OF SHEEP IN POUNDS—(*continued*).

TABLE VII.

APPENDIX 6. *Group VII* EXPERIMENT 7.

Sheep No.	25.3.35.	22.4.35.	20.5.35.	18.6.35.	16.7.35.	12.8.35.	9.9.35.	7.10.35.	4.11.35.
7	36·5	38·5	37·5	40·0	43·0	46·5	48·5	53·0	44·5
10	40·0	44·0	43·5	48·0	50·0	54·0	57·0	63·0	56·5
11	42·5	46·0	49·0	51·0	54·0	57·0	60·5	61·5	59·0
14	40·5	45·5	50·0	56·0	61·5	68·0	74·5	78·5	71·0
15	44·0	45·5	45·5	48·5	50·5	54·0	59·5	65·0	59·0
19	47·0	45·5	41·5	45·5	46·5	48·0	51·0	54·0	49·5
22	42·0	44·5	47·5	50·0	52·0	57·5	61·5	66·0	59·5
24	38·5	42·0	46·0	48·0	52·0	55·5	58·5	61·5	59·5
26	39·0	39·5	37·5	39·5	41·5	45·5	48·0	53·0	48·0
30	41·5	41·0	42·0	45·5	50·5	56·5	62·5	65·5	62·0
Totals	411·5	432·0	440·0	472·0	501·5	542·5	581·5	621·0	568·5
Averages	41·2	43·2	44·0	47·2	50·2	54·2	58·2	62·1	56·8

TABLE VIII.

Group VIII.

1	41·5	45·0	44·5	49·5	50·0	53·0	55·0	60·5	54·5
2	46·0	54·0	52·5	58·5	63·5	70·5	76·0	79·0	74·0
5	38·5	42·0	47·0	52·0	55·0	57·5	63·5	69·0	65·0
8	37·5	39·5	41·0	44·0	45·5	51·5	54·5	59·5	56·0
12	41·0	41·0	40·0	42·5	44·5	47·5	52·0	55·0	48·5
16	42·5	44·0	41·5	43·5	44·0	47·5	48·0	53·5	50·5
20	47·0	54·5	56·0	62·0	66·0	68·5	73·0	76·5	71·5
23	40·0	44·5	47·5	54·0	58·0	60·5	68·5	70·0	63·5
27	37·0	40·5	41·5	46·5	50·0	53·0	56·5	57·5	55·5
28	41·0	41·5	40·5	44·0	45·5	48·5	52·0	52·5	49·0
Totals	412·0	446·5	452·0	496·5	522·0	558·0	599·0	633·0	588·0
Average	41·2	44·6	45·2	49·6	52·2	55·8	59·9	63·3	58·8

TABLES IX–XVI: OESTROUS OBSERVATIONS.

APPENDIX 6. TABLE IX. *Group I.* EXPERIMENT 7.

Sheep No.	Occurrences of oestrus.									No. of dioestrous cycles.	Period of sexual inactivity.	
	17th March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	15th Nov.		Prior to onset of sexual season.	Subsequent to termination of sexual season.
											Days.	Days.
41629.....	—	—	—	—	—	—	—	—	—	0	—	244
41641.....	—	—	—	—	—	—	—	—	—	0	—	244
41647.....	—	—	—	—	—	—	—	—	—	0	—	244
41648.....	—	—	—	—	—	—	—	—	—	0	—	244
42393.....	—	—	—	—	—	—	—	—	—	0	—	244
42394.....	—	—	—	—	—	—	—	—	—	0	—	244
42396.....	—	—	—	—	—	—	—	—	—	0	—	244
42397.....	—	—	—	—	—	—	—	—	—	0	—	244
42398.....	—	—	—	—	—	—	—	—	—	0	—	244
42399.....	—	—	—	—	—	—	—	—	—	0	—	244
TABLE X. *Group II.*												
41624.....	—	—	—	—	—	—	—	—	—	0	—	244
41625.....	—	—	—	—	—	—	—	—	—	0	—	244
41630.....	—	—	—	—	—	—	—	5	—	1	202	41
41632.....	—	—	8,	5, 25	—	—	—	—	—	3	52	143
41639.....	—	—	—	—	—	—	—	—	—	0	—	244
41640.....	—	—	—	—	—	—	—	—	—	0	—	244
41642.....	—	—	—	—	—	—	—	—	—	0	—	244
41650.....	—	—	—	—	—	—	—	—	—	0	—	244
41652.....	—	—	—	—	—	—	—	—	—	0	—	244
42395.....	—	—	—	—	—	—	—	—	—	0	—	244
TABLE XI. *Group III.*												
41623.....	—	—	—	—	—	—	—	—	—	0	—	244
41626.....	—	—	—	—	—	—	—	—	—	0	—	244
41627.....	—	—	—	—	—	—	—	—	—	0	—	244
41628.....	—	—	—	—	—	—	—	—	—	0	—	244
41635.....	—	—	—	—	—	—	—	—	—	0	—	244
41638.....	—	—	—	—	—	—	—	,23	—	1	220	23
41644.....	—	—	13,	—	—	—	—	—	—	1	57	186
41645.....	—	—	—	—	—	—	—	—	—	0	—	244
41649.....	—	—	—	—	—	—	—	—	—	0	—	244
42392.....	—	—	—	—	—	—	—	—	—	0	—	244

OESTROUS OBSERVATIONS—(*continued*).

APPENDIX 6. TABLE XII. *Group IV.* EXPERIMENT 7.

Sheep No.	Occurrences of oestrus.									No. of dioestrous cycles.	Period of sexual inactivity.	
	17th March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	15th Nov.		Prior to onset of sexual season.	Subsequent to termination of sexual season.
											Days.	Days.
41633	—	—	—	—	—	—	—	—	—	0	—	244
41634	—	—	2, 19	—	—	—	—	—	—	2	46	80
41636	—	—	15,	—	—	—	—	—	—	1	59	184
41637	—	—	—	—	—	—	—	—	—	0	—	244
41631	—	—	—	1,	—	—	—	—	—	1	74	167
41643	—	—	—	—	—	—	—	—	—	0	—	244
41646	—	—	—	—	—	—	—	—	—	0	—	244
41651	—	—	—	—	—	—	—	—	—	0	—	244
42390	—	—	—	—	—	—	—	—	—	0	—	244
42391	—	—	—	—	—	—	—	—	—	0	—	244

TABLE XIII. *Group V.*

		1st.										
M1	—	,18	5, 23	11, 28	—	—	—	—	—	5	17	140
M2	—	—	—	—	—	—	—	—	—	0	—	229
M3	—	—	,23	—	—	—	—	—	—	1	52	176
M4	—	,26	15,	1,	—	—	—	—	—	3	25	167
M5	—	14, 22	2, 15, 26	13,	12,	—	—	—	—	7	13	126
M6	—	—	—	—	—	—	—	—	—	0	—	229
M7	—	—	—	—	—	—	—	—	—	0	—	229
M8	—	,23	10, 29	,16	—	—	—	—	—	4	22	152
M9	—	—	—	—	—	—	—	—	—	0	—	229
M10	—	—	—	—	—	—	—	—	—	0	—	229

TABLE XIV. *Group VI.*

		8th.										
3	—	—	—	—	—	—	—	—	—	0	—	222
4	—	—	—	—	—	—	—	—	—	0	—	222
6	—	—	—	—	—	—	—	—	—	0	—	222
9	—	—	—	—	—	—	—	—	—	0	—	222
13	—	—	—	—	—	—	—	—	—	0	—	222
17	—	—	—	—	—	—	—	—	—	0	—	222
18	—	—	—	,25	12, 30	,17	—	—	—	4	78	90
21	—	—	—	,22	—	—	—	—	—	1	75	146
25	—	—	—	—	—	—	—	—	—	0	—	222
29	—	—	—	—	—	—	—	—	—	0	—	222

APPENDIX 6. EXPERIMENT 7.

TABLE XV. *Group VII.*

Sheep No.	Occurrences of oestrus.									No. of dioestrous cycles.	Period of sexual inactivity.	
	March.	8th April.	May.	June.	July.	Aug.	Sept.	Oct.	15th Nov.		Prior to onset of sexual season.	Subsequent to termination of sexual season.
											Days.	Days.
7	—	—	—	—	—	—	—	—	—	0	—	222
10	—	,28	15,	—	—	—	—	—	—	2	20	184
11	—	—	—	—	—	—	—	—	—	0	—	222
14	—	,28	15,	—	—	—	—	—	—	2	20	184
15	—	—	—	—	—	—	—	—	—	0	—	222
19	—	,18	5, 23	9,	15,	—	—	—	—	5	10	123
22	—	—	—	—	—	—	—	—	—	0	—	222
24	—	—	—	,25	11, 29	—	—	—	—	3	78	109
26	—	—	—	—	—	—	—	—	—	0	—	222
30	—	—	—	—	—	—	—	—	—	0	—	222

TABLE XVI. *Group VIII.*

1	—	—	,19	,25	,13	—	—	—	—	3	41	125
2	—	—	—	—	—	—	—	—	—	0	—	222
5	—	—	—	—	—	—	—	—	—	0	—	222
8	—	—	—	—	—	—	—	—	—	0	—	222
12	—	—	—	—	—	—	—	—	—	0	—	222
16	—	—	—	—	—	—	—	—	—	0	—	222
20	—	—	,15	,23	—	—	—	—	—	2	37	145
23	—	—	—	—	—	—	—	—	—	0	—	222
27	—	—	—	—	—	—	—	—	—	0	—	222
28	—	—	—	—	—	—	—	—	—	0	—	222

APPENDIX 7.

EXPERIMENT 8.

TABLES I–VI.—WEIGHTS OF SHEEP IN POUNDS.

TABLE I. *Group I.*

Sheep No.	1933.						1934.								
	13.10.	27.10.	9.11.	25.11.	9.12.	23.12.	6.1.	20.1.	2.2.	17.2.	3.3.	17.3.	29.3.	14.4.	28.4.
15363	86·0	90·5	89·5	93·5	95·0	97·0	95·5	98·5	101·5	103·5	95·0	97·0	96·5	97·5	95·5
21469	64·0	72·5	76·5	76·5	78·5	81·0	81·0	84·0	88·5	87·0	82·0	82·0	81·5	83·0	83·0
21544	66·0	72·0	77·0	77·5	80·5	83·5	89·0	89·5	90·5	84·5	74·5	80·5	77·5	81·5	80·5
21566	66·0	74·5	80·0	78·5	79·0	79·5	83·5	83·0	85·0	83·0	71·5	77·5	77·0	78·5	76·0
25956	73·0	82·0	87·0	92·0	95·5	96·0	99·5	101·0	105·5	102·0	95·5	98·0	98·0	99·5	101·0
25957	68·0	77·5	78·0	75·5	82·0	85·0	85·5	85·5	91·5	90·5	84·0	87·5	84·0	84·0	88·5
32935	64·0	71·0	76·5	75·5	79·0	83·5	87·5	84·0	90·5	89·5	82·0	87·0	87·0	88·0	87·0
35728	48·5	57·5	57·0	57·5	58·5	64·0	68·0	66·0	67·5	68·0	64·5	62·5	61·0	63·0	62·5
35969	68·0	73·0	79·5	78·5	78·5	81·5	87·0	86·0	90·0	91·0	89·0	85·5	85·0	87·0	84·0
37066	73·0	82·0	87·5	85·0	87·0	92·0	98·0	97·0	102·0	98·5	92·5	92·5	92·0	92·0	93·5
Totals	676·5	752·5	788·5	790·0	813·5	843·0	874·5	874·5	912·5	897·5	830·5	850·0	839·5	854·0	851·5
Averages	67·6	75·2	78·8	79·0	81·4	84·3	87·4	87·4	91·2	89·8	83·0	85·0	84·0	85·4	85·2

TABLE II. *Group II.*

15364	70·0	80·5	83·0	87·5	84·0	89·5	90·5	90·5	98·0	100·0	100·0	101·0	99·0	99·5	99·0
22086	64·0	67·5	70·0	70·5	66·5	72·5	74·5	74·0	77·5	76·0	75·5	77·0	77·0	76·5	77·5
25027	68·5	74·0	75·5	75·5	74·5	79·0	80·5	78·5	82·0	80·0	83·0	86·5	84·5	85·5	83·5
25034	64·0	66·5	73·5	73·5	67·0	74·0	80·0	76·5	82·0	84·5	82·0	84·5	84·0	86·0	84·0
25072	68·0	74·5	78·0	74·5	70·0	75·0	78·5	77·0	78·5	79·0	78·0	78·5	78·5	78·0	78·5
25082	50·5	55·0	58·0	57·5	55·0	57·5	62·5	60·0	64·0	61·5	65·0	65·5	61·0	64·0	64·0
35981	84·5	90·5	94·0	95·0	90·5	95·0	101·0	101·0	103·0	105·5	103·5	104·5	104·0	107·5	105·0
35982	73·0	78·0	79·5	80·5	75·0	79·0	83·0	79·5	85·0	84·0	84·0	86·0	86·0	86·0	86·0
37065	65·5	76·5	79·5	81·0	79·5	84·0	88·0	85·5	88·5	90·0	88·0	90·5	88·0	89·5	91·5
38531	66·0	74·0	80·0	79·5	73·5	81·0	83·0	81·0	87·5	86·0	82·5	85·5	84·0	84·5	83·5
Totals	677·0	737·0	771·0	775·0	735·5	786·5	821·5	802·5	846·0	846·5	841·5	859·5	846·0	857·0	853·0
Averages	67·7	73·7	77·1	77·5	73·6	78·6	82·2	80·2	84·6	84·6	84·2	86·0	84·6	85·7	85·3

WEIGHTS OF SHEEP IN POUNDS—(*continued*).

APPENDIX 7. TABLE III. *Group III.* EXPERIMENT 8.

Sheep No.	1933.						1934.								
	13.10.	27.10.	9.11.	25.11.	9.12.	23.12.	6.1.	20.1.	2.2.	17.2.	3.3.	17.3.	29.3.	14.4.	28.4.
25878	74·5	82·5	91·5	91·0	89·5	91·5	96·0	95·0	95·0	97·0	95·0	97·0	96·5	93·5	94·0
25925	66·5	71·0	75·0	74·0	72·5	75·5	77·5	75·5	80·5	82·0	83·0	80·0	82·0	84·0	79 5
25926	58·0	66·5	67·0	67·0	67·5	74·0	75·0	76·0	72·5	69·5	75·0	75·5	72·0	73·5	75·5
25930	72·0	75·0	79·5	84·0	76·0	84·0	86·0	87·0	92·5	91·0	91·0	93·0	91·5	94·0	91·5
26243	68·0	76·0	80·5	83·5	79·0	83·0	86·5	84·5	89·5	89·0	92·5	92·0	91·5	91·0	89·0
35596	63·5	70·0	73·5	70·0	64·5	72·5	69·5	70·5	74·5	71·5	77·0	77·5	75·0	75·0	75·5
25645	65·5	70·0	72·0	73·5	65·5	73·0	77·5	77·0	77·5	75·5	77·5	80·0	73·0	72·5	72·0
35965	64·5	71·0	72·5	70·5	70·0	73·5	73·0	74·0	79·0	76·5	79·0	77·5	78·5	79·0	77·0
37067	69·0	75·0	78·5	83·0	79·5	85·5	90·5	88·5	92·0	92·0	90·5	92·0	93·0	93·0	91·0
38532	83·5	87·5	89·5	88·5	85·5	89·5	92·0	88·0	93·5	93·0	95·0	96·5	97·0	94·0	94·0
Totals	685·0	744·5	779·5	795·0	749·5	802·0	823·5	816·0	846·5	837·0	855·5	861·0	850·0	849·5	839·0
Averages	68·5	74·4	78·0	79·5	75·0	80·2	82·4	81·6	84·6	83·7	85·6	86·1	85·0	85·0	83·9

TABLE IV. *Group IV.*

15426	63·0	69·0	73·5	71·0	73·0	78·5	82·5	80·0	83·5	83·5	78·5	80·0	79·0	81·0	79·5
21619	71·5	80·5	83·0	82·5	84·5	88·0	90·5	87·0	89·0	90·5	82·0	85·0	80·5	84·0	85·5
24247	81·0	86·5	85·0	88·0	85·0	96·5	99·5	99·0	99·5	94·0	86·5	94·5	92·0	94·0	94·0
25915	70·0	71·0	80·0	78·5	82·0	88·0	88·0	87·5	91·5	89·0	85·0	83·5	84·5	86·5	84·0
32490	59·0	63·0	66·0	64·0	65·0	65·5	70·5	65·0	67·0	70·5	64·5	68·5	68·5	66·0	70·0
33015	65·5	71·0	75·5	74·5	76·5	79·0	83·5	80·5	83·0	81·5	76·5	78·0	74·0	76·5	76·0
35970	67·5	67·0	75·5	72·5	75·5	81·5	82·0	79·0	85·5	84·5	75·0	82·0	83·0	82·5	83·5
36005	74·5	79·0	83·0	84·0	87·0	86·0	91·0	87·0	94·5	91·5	84·5	90·5	87·5	87·0	88·0
36007	64·5	69·0	—	72·0	76·0	79·5	81·0	82·0	88·5	88·5	82·5	86·5	82·0	83·5	85·0
36013	68·5	75·0	81·0	72·5	78·0	85·5	91·0	85·5	91·5	89·5	82·0	86·5	84·0	82·0	85·5
Totals	685·0	731·0	702·5	759·5	782·5	828·0	859·5	832·5	873·5	840·0	797·0	835·0	815 0	823·0	831·0
Averages	68·5	73·1	78·0	76·0	78·2	82·8	86·0	83·2	87·4	84·0	79·7	83·5	81·5	82·3	83·1

WEIGHTS OF SHEEP IN POUNDS—(*continued*).

APPENDIX 7. TABLE V. *Group V.* EXPERIMENT 8.

Sheep No.	1933.						1934.								
	13.10.	27.10.	9.11.	25.11.	9.12.	23.12.	6.1.	20.1.	2.2.	17.2.	3.3.	17.3.	29.3.	14.4.	28.4.
22014	70·5	72·0	78·0	75·5	79·0	86·5	89·5	89·5	92·5	93·0	82·5	83·5	84·0	85·6	86·5
22024	61·5	66·5	69·0	67·5	68·5	83·0	76·5	76·5	80·0	81·5	75·0	78·5	75·0	78·0	78·5
22050	65·0	78·0	82·5	85·0	83·5	94·0	94·0	90·0	94·5	95·5	90·0	94·0	91·0	93·5	91·0
25932	75·0	82·0	87·0	88·0	90·5	92·5	93·0	97·5	102·0	98·5	90·0	94·0	93·0	97·0	93·5
25950	70·5	73·5	77·0	74·5	80·5	83·5	87·0	88·0	92·0	93·0	93·0	86·0	85·5	87·5	88·5
26302	76·0	82·0	96·0	88·0	94·0	98·0	97·0	97·0	100·0	102·0	93·0	96·0	93·0	95·0	96·5
29250	67·5	66·0	73·5	73·5	78·0	79·0	85·0	83·5	87·5	88·0	82·0	83·0	—	73·0	75·0
35973	62·5	67·5	70·5	69·0	71·0	75·0	75·0	77·0	81·5	82·0	76·5	73·5	76·0	79·0	78·5
35984	67·5	75·5	75·0	79·0	79·0	83·5	89·0	87·0	89·0	90·5	83·5	85·5	85·0	83·0	84·0
38530	64·5	69·0	68·0	65·5	68·5	72·5	72·0	74·5	77·5	78·5	66·5	72·0	73·0	76·0	74·5
Totals	680·5	731·5	766·5	765·5	792·5	837·5	858·0	860·5	896·5	902·5	822·0	846·0	755·5	848·5	846·5
Averages	68·0	73·2	76·6	76·6	79·2	83·8	85·8	86·0	89·6	90·2	82·2	84·6	83·9	84·8	84·6

TABLE VI. *Group VI.*

15360	—	—	—	106·5	99·5	104·5	108·5	109·5	111·0	110·0	109·0	110·5	110·0	109·5	108·0
21434	—	—	—	79·5	73·0	79·0	80·5	82·5	87·5	84·5	84·5	84·0	84·0	86·0	86·0
35568	—	—	—	63·5	60·5	61·5	64·5	64·5	68·0	64·0	64·0	64·0	65·0	64·0	64·5
35631	—	—	—	80·0	73·5	77·0	78·0	74·0	77·0	76·0	78·0	75·5	73·0	74·5	74·0
35570	—	—	—	92·0	85·0	86·0	89·5	89·0	88·0	89·0	88·0	91·5	87·0	86·5	82·5
35571	—	—	—	91·0	82·0	83·5	87·0	87·5	91·5	86·0	89·0	90·5	90·0	90·5	89·5
35585	—	—	—	86·0	77·0	82·0	85·5	80·0	82·0	82·5	85·0	83·0	82·5	84·0	82·5
35578	—	—	—	67·5	63·0	70·5	74·0	71·5	77·5	73·0	78·0	80·0	78·5	81·0	79·5
35703	—	—	—	72·0	65·0	70·0	70·5	69·0	74·0	72·0	71·5	72·5	71·5	71·0	72·0
35888	—	—	—	86·5	82·0	86·5	89·0	85·5	93·0	92·5	92·5	92·0	90·0	93·5	93·0
Totals	—	—	—	824·5	760·5	800·5	827·0	817·0	849·5	829·5	839·5	844·5	831·5	840·5	831·5
Averages	—	—	—	82·4	76·0	80·0	82·7	81·7	85·0	83·0	84·0	84·4	83·2	84·0	83·2

TABLES VII–XII: OESTROUS OBSERVATIONS.

APPENDIX 7. TABLE VII. *Group I.* Sexual Season, 1933-34. EXPERIMENT 8.

Sheep No.	1933. Oct.	1933. Nov.	1933. Dec.	1934. Jan.	1934. Feb.	1934. March.	1934. April.	Inactive period, Oct.–Nov.–Dec., 1933. (Days.)	Periodicity of oestrus in days.
15363....	—	—	11,28	14, 31	, 18	6, 25	11, 28	62	— — — 17 17 17 — 18 16 19 17 17
21469....	—	—	—	4, 21	7, 25	, 16	3, 21	86	— — — — 17 — 17 18 — 19 18 18
21544....	—	—	—	—	—	, 27	13,	168	— — — — — — — — — — 17 —
21566....	—	—	—	7, 24	10, 28	, 16	4, 20	89	— — — — 17 17 18 — — 16 19 16
25956....	—	—	—	3, 23	10, 27	, 16	3, 20	85	— — — — 20 18 17 — — 17 18 17
25957....	—	—	—	2, 18	4, 21	10, 27	13, 30	84	— — — — 16 17 17 17 17 17 17 17
32935....	—	—	—	—	—	3, 21	8,	144	— — — — — — — 18 18 — — —
35728....	—	—	—	—	—	—	—	(210)	— — — — — — — — — — — —
35969....	—	, 28	13, 29	15,	1, 18	6, 24	9, 25	49	— — — 15 16 17 — 16 18 16 16 16
37066....	—	—	—	, 29	, 16	5, 21	7, 24	111	— — — — — — 18 17 — 16 17 17

TABLE VIII. *Group II.*

15364....	—	—	—	1,	—	11, 28	—	83	— — — — — — — — — — 69 17
22086....	—	—	—	—	—	—	—	(241)	— — — — — — — — — — — —
25027....	—	—	—	11, 28	14,	4,	7, 24	93	— — — — 17 — 18 — 17 — 34 17
25034....	—	—	—	2, 19	4, 20	9, 26	11, 28	84	— — — — 17 — 17 17 16 16 17 17
25072....	—	—	—	, 28	12, 28	, 16	1,	110	— — — — — — — — 15 16 — 16 —
25082....	—	—	—	—	—	9,	, 29	150	— — — — — — — — — — — 51
35981....	—	—	—	—	4, 21	10,	15,	117	— — — — — — 17 — 17 — 36 —
35982....	—	—	—	—	7, 25	14,	—	120	— — — — — — 18 — 17 — — —
37065....	—	—	—	—	7, 24	12,	14, 30	120	— — — — — — 17 — 16 — 33 16
38531....	—	—	—	—	—	—	—	(208)	— — — — — — — — — — — —

TABLE IX. *Group III.*

25878....	—	—	—	1, 17	3, 20	, 26	12, 28	83	— — — — — — — 16 — 34 17 16
25925....	—	—	, 16	4, 20	7, 25	15,	1, 18	67	— — — — — — 19 16 18 17 17 —
25926....	—	—	, 28	14,	1, 18	8, 26	12, 30	79	— — — — — — 17 — 18 18 17 18
25930....	—	, 29	, 19	5, 21	7, 24	12, 29	15,	50	— — — — — 20 17 16 17 17 17 —
26243....	—	—	—	—	—	10,	14, 30	151	— — — — — — — — — — 35 16
35596....	—	—	—	—	, 17	6, 22	8, 26	130	— — — — — — 17 16 17 17 18 18
35645....	—	—	—	—	—	—	—	(No oestrus.)	— — — — — — — — — — — —
35965....	—	—	—	—	—	—	—	(No oestrus.)	— — — — — — — — 17 18 — —
37067....	—	—	—	, 24	10, 28	, 17	3, 20	106	— — — — — — 18 — 17 17 17 17
38532....	—	—	, 25	12, 30	, 17	7, 26	14,	76	— — — — — — 18 18 — 18 19 —

TABLE X. *Group IV.*

15426....	—	—	—	—	—	, 31	, 17	172	— — — — — — — — — — — 17
21619....	15,	2, 19	8, 26	13, 31	, 17	, 24	11, 28	No anoestrum.	— — — — — — 18 — — — 35 18 17
24247....	—	—	—	10, 28	14,	3, 19	5, 22	92	— — — — — — 18 — — 17 16 17 17
25915....	—	—	—	7, 24	10, 26	, 16	1, 18	89	— — — — — — 17 — — 17 18 16 17
32490....	—	—	—	—	1, 18	8, 27	—	114	— — — — — — — — — — 18 19 — —
33015....	—	—	—	, 31	, 18	7,	, 30	113	— — — — — — — — — — 17 — 54
35970....	—	—	—	—	7, 24	, 29	15,	120	— — — — — — — — — — 33 17 —
36005....	—	—	—	—	, 23	11, 28	15,	136	— — — — — — — — — — 16 17 18 —
36007....	—	—	—	2, 18	4, 21	9, 26	12, 29	84	— — — — — — — 16 — — 16 17 17 17
36013....	—	—	—	—	—	8,	12, 29	149	— — — — — — — — — — — 35 17

TABLE XI. *Group V.*

22014....	, 29	, 29	, 16	3, 20	7, 25	14, 31	, 17	No anoestrum.	— — 31 17 18 17 — 17 17 17
22024....	—	—	—	—	2, 18	9, 25	11, 29	115	— — — — — — 19 16 17 18
22050....	—	—	—	, 31	—	6, 24	—	113	— — — — — — 34 18 — —
25932....	—	—	8, 25	11, 28	13,	3, 19	5, 22	59	— — — 17 — 17 17 16 — 17
25950....	, 17	1, 17	4, 20	7, 23	9, 26	15,	1, 17	No anoestrum.	15 16 17 16 — — 18 17 16 — —
26302....	—	—	, 19	5, 23	10, 27	, 17	5, 23	70	— — — — — — 17 17 16 18 —
29250....	—	—	—	, 28	—	6,	15,	110	— — — — — — — — — — 40 —
35973....	—	—	—	—	—	—	, 18	190	— — — — — — — 19 — — — —
35984....	—	—	—	2, 21	9, 28	, 19	5, 25	84	— — — — — — 19 — 19 17 — 20
38530....	—	—	—	—	—	—	2,	174	— — — — — — — — — — — —

TABLE XII. *Group VI.*

15360....	—	—	, 25	11, 28	14,	3, 20	6, 23	73	— — — — 17 17 17 — 17 17 17 —
21434....	—	—	—	4,	9, 26	15,	2,	83	— — — — — — 36 — — 18 — —
35568....	—	—	—	—	—	, 21	6, 24	160	— — — — — — — — 16 18 — —
35631....	—	—	—	3, 20	6, 24	13, 30	, 17	82	— — — — — — 17 17 17 18 18 —
35570....	—	—	—	9, 26	12,	, 23	, 28	88	— — — — — — 17 17 39 — 32 —
35571....	—	—	, 22	8, 27	15,	5,	15,	70	— — — — — 17 19 19 — 18 41 —
35585....	—	—	—	, 28	, 23	, 29	15,	107	— — — — — — — 26 — 34 — — —
35578....	—	—	—	—	, 16	4,	9,	126	— — — — — — — — — — 36 — —
35703....	—	—	—	—	, 22	12, 30	, 17	132	— — — — — — 17 — — 18 18 — —
35888....	—	—	—	—	—	, 22	8, 25	161	— — — — — — — — — 16 17 — —

Oestrous observations commenced on 13.10.33.

Not inoculated. Not shorn.

Not inoculated. Shorn on 27.11.33.

Inoculated 24.10.33. Shorn, 27.11.33.

Not inoculated. Shorn 17.11.33.

Not dipped.

Dipped on 12.1.34.

Not dipped. Inoculated 5.2.34.

Dipped on 2.2.34.

Shorn on 26.2.34. Dipped 17.3.34.

No treatment.

APPENDIX 7A.

EXPERIMENT 8.

MACROSCOPIC EXAMINATION OF THE OVARIES OF INACTIVE SHEEP.

(1) *Sheep No.* 35645.—Date slaughtered, 15th August, 1934; age, 6 years; condition, fair; weight, 81·0 lb.

Sexual History.—No exhibition of oestrus was observed during the testing period, 13th October, 1933, to 5th October, 1934.

Left Ovary.—Weight, 0·55 gm.; measurements, 1·5 by 0·9 by 0·7 cm.

Only two small Graafian follicles with diameters of 0·1 and 0·2 cm. are seen near the surface of the ovary.

No corpus luteum is present but some remnants of previous corpora lutea are seen.

Right Ovary.—Weight, 0·81.; measurements, 1·6 by 1·1 by 0·9 cm.

One large Graafian follicle with a diameter of 0·5 cm. is seen on a pole of the ovary, while numerous smaller follicles are present.

No corpus luteum is present but many remnants of previous corpora lutea are seen.

(2) *Sheep No.* 35965.—Date slaughtered, 22nd June, 1934; age, 6 years; condition, fair; weight, 75·0 lb.

Sexual History.—No exhibition of oestrus was observed during the period of testing, 13th October, 1933, to 22nd June, 1934.

Left Ovary.—Weight, 0·66 gm.; measurements, 1·3 by 1·0 by 0·6 cm.

Numerous small Graafian follicles are seen, the largest of which is 0·3 cm. in diameter.

A cone shaped corpus luteum measuring 0·9 by 0·7 cm. is present. The corpus has been sectioned and it is found to have a cavity 0·3 cm. in diameter. The remnants of previous corpora lutea occur as dark brown specks.

Right Ovary.—Weight, 0·61 gm.; measurements, 1·3 by 1·0 by 0·6 cm.

Three Graafian follicles varying in size from 0·4 to 0·1 cm. are seen.

A corpus luteum in the form of a complete circular ball 0·6 cm. in diameter is found attached to and entirely outside the ovary. Externally the colour of the body is cream and on section the colour of the cut surfaces is somewhat lighter. This is apparently a corpus luteum of the previous interovulation period somewhat abnormally situated.